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19 NOVEMBER 1996

TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

CRASH FIRE RESCUE TRAINING FACILITY

TYBRIN Corporation
F08635-90-C-0026

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NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES/PAGES

List of Current Changes

Original 0 19 NOV 96

Only those work packages/pages assigned to the manual are listed in this index. Insert Change _____, dated _____. Dispose of superseded and deleted work packages/pages. Superseded and deleted classified work packages/pages shall be destroyed in accordance with applicable regulations. If changed pages are issued to a work package, insert the changed pages in the applicable work package. The portion of the text affected in a change or revised work package is indicated by change bars or the change symbol "R" in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands or change bars as applicable.

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002 00	Foreword	006 00	Quarterly System Safety Inspection
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WORK PACKAGE

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EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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WORK PACKAGE

MASTER LISTS

MASTER LIST OF SPECIAL TOOLS, EQUIPMENT AND CONSUMABLES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

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Master List of Special Tools

Part/Specification No.	CAGE Code	Figure & Index No.	Nomenclature	Use
GSE Extrusion Welder, 120V			GSE Part Number 3668 (GSE Lining Technol- ogy, Inc. 19103 Gundle Road, Houston Texas 77073)	Repair tears or holes in liner
Grinder, Black and Decker, 4 1/2 inch, 120V			GSE Part Number 0128 (GSE Lining Technol- ogy, Inc. 19103 Gundle Road, Houston Texas 77073)	Repair tears or holes in liner
Hot Air Blower, 120V			GSE Part Number 0127 (GSE Lining Technol- ogy, Inc. 19103 Gundle Road, Houston Texas 77073)	Repair tears or holes in liner

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS

FOREWORD

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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None

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Reference Material Required

None

1. PURPOSE.

This manual contains a series of Work Packages (WP) and Subordinate Work Packages (SWP) which provide complete operating instructions and instructions for intermediate and field level maintenance of the Crash Fire Rescue Training Facility. The intent of this system is to create a safe live fire training environment for fire fighters.

2. SCOPE.

The complete set of work packages covers all approved operations, inspection, and fault isolation.

3. ABBREVIATIONS/ACRONYMS.

The following abbreviations/acronyms are used in this manual.

LIST OF ABBREVIATIONS/ACRONYMS

<u>TERM</u>	<u>DEFINITION</u>
SWP	Subordinate Work Package
WP	Work Package

4. RELATED PUBLICATIONS.

The following publications are referenced in and used in conjunction with this manual.

LIST OF RELATED PUBLICATIONS

None

5. USE OF SHALL, WILL, SHOULD, AND MAY.

Use of the word "shall" indicates a mandatory provision that is binding. Use of the words "should" and "may" express non-mandatory provisions. The word "will" is used to express a declaration of purpose. "Will" may also be used to show simple futurity, e.g., "Power for the meter will be provided by the ship".

6. TIME COMPLIANCE TECHNICAL ORDERS (TCTO).

The following TCTOs are applicable to the Crash Fire Rescue Training Facility.

LIST OF TIME COMPLIANCE TECHNICAL ORDERS

<u>TCTO</u> <u>NUMBER</u>	<u>TCTO</u> <u>TITLE</u>	<u>TCTO</u> <u>DATE</u>
None		

7. MANUAL STRUCTURE.

This manual is divided into WPs and SWPs. Each WP is an independent, task oriented unit. Only essential information is provided. WPs cover the subjects of alphabetical indexes, foreword, theory of operation, operating instructions, troubleshooting, inspection and repair. A WP is subdivided into SWPs when one division by WP is not sufficient to maintain a logical sequence of data, for clarity, or to isolate specific maintenance level requirements.

8. WP BREAKOUT.

The WPs are arranged in disassembly sequence. The Alphabetical Index (WP 001 00) provides a complete list of all WPs and SWPs.

9. LOCATING INFORMATION.

The Numerical Index of Effective Work Packages lists in numerical order all WPs and SWPs contained in this manual and provides the model application for each WP/SWP. The Alphabetical Index WP lists in alphabetical order all WPs and SWPs contained in this manual. Each WP/SWP contains a table of contents which lists all procedures contained in that WP/SWP. Reference to paragraphs, tables, or figures within a WP are made by number, e.g. paragraph 7, table 2, or figure 3. A reference to another WP merely includes the WP or SWP number, e.g. WP 008 00 or SWP 006 01. To find a par-

ticular procedure or topic, it is necessary to refer to that WP or SWP.

10. LEADING PARTICULARS.

Due to the nature and geographic diversity of each site, it would be impractical to list all leading particulars in this manual. Wherever possible those items with a high probability of site specific installation will be identified by the words, "if applicable".

11. PRINCIPLES OF OPERATION.

11.1 Description. The Air Force Crash Fire Rescue Training Facility is a generic site adaptable design. The design incorporates a 100-foot (30 meter) diameter burn area with flexible membrane liner, a holding pond for water recycling, and a Liquid Propane fuel system. An overall view of the facility is shown in Figure 1. The design allows quality fire training exercises to maintain firefighting proficiency while maintaining the necessary controls.

11.2 Configuration. A 100-foot (30 meter) lined burn area with an aircraft mock-up and 10,000 water gallons (38,000 liters) of liquid propane fuel provide the live fire necessary to simulate multi-aircraft type fires. A typical training scenario includes filling the area to one inch (2.54 cm) above the aggregate level, supplying propane to the burn area through underground pipes, and igniting the fuel by activating 10,000 volt, 23 milliampere, one end ground ignitors located in the burn area. Various switches and valves located on the control stand are used to control the fire(s) during training. The fully lined facility completely protects the environment from ground water contamination.

12. MAINTENANCE CONCEPT.

This facility will be maintained by Civil Engineering or contractor personnel. The replacement of valves, piping, etc., and cleaning, painting, lubricating and corrosion control will be accomplished utilizing established Civil Engineering procedures and per the manufacture's instruction. SWP 008 01 contains excavation procedures for gaining access to and subsequent back-fill of underground components. Inspection criteria for specific components will be as per the manufacture's instruction.

13. TOLERANCES, CLEARANCES, AND WEAR LIMITS.

Each inspection and repair WP contains an inspection table, if applicable. Identified in each table are inspection area, condition, serviceable and repairable limits, and corrective action.

13.1 Wear Limits. Two kinds of limits are identified, serviceable and repairable. A limit is the condition beyond which deterioration of a part necessitates repair or replacement. The SERVICEABLE LIMITS column defines the maximum departure from manufacturer's established standard that will not materially reduce the usability of the part. If a part is within serviceable limits, no corrective action is required. The REPAIRABLE LIMITS column defines the maximum deterioration of a part from manufacturer's established standard that is repairable. If a part is within repairable limits but exceeds serviceable limits, it must be repaired in accordance with the CORRECTIVE ACTION column. If a part exceeds repairable limits, it is not repairable and must be replaced. If a part is not serviceable and not repairable, it must be replaced.

14. PART IDENTIFICATION.

All training facility parts must be identified at disassembly. Identification may include part number, serial number (when applicable), or physical description.

15. ONE TIME USE ITEMS.

The following listed items shall be considered as consumable and shall be discarded upon disassembly to prevent reuse unless manufacturer authorized rebuild/repair kit is available. Solenoids, regulators, valves, switches, and ignitors.

16. IMPROVEMENT REPORTS.

Recommendations proposing changes to this manual should be submitted on AFTO Form 22 in accordance with TO 00-5-1 and forwarded to HQ AFCEA/CEXF, 139 Barnes Drive Suite 1, Tyndall AFB, Florida 32404-5319.

Master List of Test Equipment

Type Designation	CAGE Code	Figure & Index No.	Nomenclature	Use
Flamable gas detector			Any manufactured gas detector capable of detecting flammable atmospheres	Inspect LPG plumbing
Vacuum Box, small			GSE Part Number 2999 (GSE Lining Technology, Inc. 19103 Gundle Road, Houston Texas 77073)	Used to Quality Check liner repairs
Portable Electric Vacuum Pump with Hose			GSE Part Number 2938 (GSE Lining Technology, Inc. 19103 Gundle Road, Houston Texas 77073)	Used to Quality Check liner repairs

Master List of Expendable Items and Consumable Materials

Nomenclature	Specification Part No.	CAGE Code	Reference	Use
Door panels			36" x 84" 26 gauge sheet metal cutout panels on mock-up	
Lock out tags				Lock out inop- erable compo- nents
Liquified Petroleum Gas	BB-G-110A Type II 6830-00-261-7445	81348	Propane	Fire Source
Nitrogen	BB-N411C Type 1, Grade A, Class 1, NSN 6830-00-616- 9183	81348	Nitrogen	Powers emer- gency system
Cylinder, com- pressed gas	RR-C-901 & 901/1 NSN 8120-00-985- 7275 or 8120-00- 286-8592 (200 cu. ft.)	81348	N ₂ Bottle	Powers emer- gency system
Turbine Fuel, Avia- tion, Kerosene Type - NATO F34 (JP-8) & NATO F35 (Jet A-1 ASTMD 1655)	MIL-T-83133D NSN 9130-01-031-5816	81349	Jet Fuel, JP-8	Fire Source
High Voltage Ignition Cable	MIL-C-3702-U5MC & U7MC NSN 6145- 00-197-8186 or 6145-00-845-1861	81349	Ignitor cable	Connection between igni- tion trans- former and ignitor
Ignitor, Champion Aviation Products	Catalog Number CH31723 NSN 2920- 00-776-4482	11583	Ignitor	Initiate Fire
Ignitor, Champion Aviation Products	Catalog Number CH31615 NSN 2920- 00-104-4461	11583	Ignitor	Initiate Fire
Pigtail Lead, Cham- pion Aviation Prod- ucts	Catalog Number 204085		Pigtail	Connect igni- tion cable to ignitor
Power Supply, Mag- netec, Jefferson Igni- tion Transformer	Catalog Number 638-171		Ignition Transformer	Power Ignitors

Master List of Expendable Items and Consumable Materials - Continued

Nomenclature	Specification Part No.	CAGE Code	Reference	Use
Emergency Valve CO-AX coaxial valves 3/4 inch	Catalog Number VKM202C(XXX)VT (y)3/4ZXG1A, xxx <u>104</u> Brass, <u>240</u> Steel, <u>640</u> Stain- less, <u>y N</u> Threaded, <u>A</u> Flanged		High Speed Valves	Shut off pro- pane
Emergency Valve CO-AX coaxial valves 1 inch	Catalog Number VKM252C(XXX)VT (y)1ZXG1A, xxx <u>104</u> Brass, <u>240</u> Steel, <u>640</u> Stain- less, <u>y N</u> Threaded, <u>A</u> Flanged		High Speed Valves	Shut off pro- pane

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS

SAFETY AND ACCIDENT PREVENTION

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

LIST OF EFFECTIVE WP PAGES

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LIST OF ILLUSTRATIONS

None

LIST OF TABLES

• None

Reference Material Required

None

1. GENERAL.

Safety requirements will be complied with during all operations. All personnel engaged in operations involving hazardous material shall be thoroughly trained in safety. They shall be capable of recognizing hazardous situations and conditions. Thinking safety and working safely must become a habit when working with or near items that can create a hazard because of their explosive, thermal, flammable, or toxic characteristics.

When an abnormal condition is noted and procedures are not available in this manual, training shall be stopped and authorized personnel shall be called for help in eliminating the hazard. Operations shall not be resumed until the hazard has been eliminated. Hazardous material information can be found in T.O. 00-105E-9, section III and hazardous material publications used to determine relative toxicity, flammability, thermal stability, permissible extinguishing agents and other pertinent data for a given substance.

WARNING

Once firefighters enter the burn area no additional fires shall be ignited.

Protective clothing in accordance with NFPA 1971, 1972, 1973, 1974, and 1976 shall be used to prevent burns from extensive heat and hot surfaces. SCBA shall be worn for all fires.

2. REQUIREMENTS.

The explosive safety standards of AFM 91-201, AFOSH and NFPA 1500 Fire Department Occupational Safety and Health Program standards will be followed. Lack of a safety requirement in this TO or the above reference does not indicate that no safeguards are needed. If a dangerous situation is encountered, other than expected dangers addressed during the exer-

cise pre-brief, all operations in the area shall be terminated. Personnel shall evacuate the training area. Authorized personnel shall be notified to correct hazard. Operations shall not be resumed until the hazard has been eliminated.

3. ABNORMAL CONDITIONS.

When an abnormal condition is noted and correction procedures are not available in this manual, training shall be terminated. Personnel will be evacuated from the training area. Authorized personnel shall be notified to eliminate the hazard. Operations shall not be resumed until the hazard has been eliminated.

4. EXPLOSIVE HAZARDS.

Liquid propane used in the facility is potential explosive. If hazardous conditions are encountered all operations shall be terminated. Personnel will be evacuated to a safe site. Authorized personnel shall be called to eliminate the hazard. Operations shall not resume until the hazard has been eliminated.

5. RESUSCITATION.

Personnel working with or near high voltage equipment should be familiar with modern methods of resuscitation. Such information can be obtained from the base medical facility.

6. EMERGENCY PROCEDURES.

The procedures under this heading shall be used in case of an emergency. Personnel directly and indirectly related to any training exercise using the Crash Fire Rescue Training Facility shall be thoroughly familiar with the procedures contained herein.

7. PROCEDURES.

7.1 Emergency Shutdown - General. During any phase of training, if an unsafe or emergency condition is observed, any member of the training evolution can

declare an emergency. Upon declaration of an emergency, the Ignition Officer shall perform the following:

- a. Activate emergency shutdown control switch on control stand.
- b. Close master/emergency power switch on electrical control stand.
- c. Close manual propane shutoff control valve on control stand.
- d. Close all manual propane distribution control valves on the LPG control rack.
- e. Position all ignitor switches located on the electrical control rack to OFF.
- f. Verify that all personnel have evacuated the burn area.

CAUTION

Ensure unsafe condition(s) have been rectified prior to performing procedures in paragraph 7.2.

7.2 Reactivation/Purge - General. After the emergency condition has been remedied, gas lines must be purged to release residual propane as follows:

- a. After instructor in charge declares the area safe the trapped propane must be purged.
- b. Reposition the emergency shutdown switch to normal position.
- c. Position all appropriate ignitor switches to ON. All ground burner switch(es) must be held in ON position.
- d. Once all burners have burned out, position all ignitor switches to OFF.
- e. Return to normal operations.

NOTE

The site may be reconfigured and training resumed after performance of the preceding

steps. Refer to Work Package 005 00, step 2, substeps a, f, g, h, i, and j, and step 3.

7.3 Emergency Shutdown - Goodfellow AFB, Texas. Upon declaration of an emergency, the Ignition Team shall perform the following:

- a. Push emergency shutdown control button on the ground control stand.
- b. Close individual burner manual control valves.
- c. Position all ignitor switches to off.
- d. Verify that all personnel have evacuated the burn area.
- e. Notify appropriate agency for correction of problem
- f. Tag inoperable components out of service.

CAUTION

If burners do not shutdown, initiate training complex emergency shutdown as follows:

- g. In control tower third floor, push the propane tank emergency shutoff (red button on wall by entrance door).
- h. Push the control panels emergency electrical shutoff (red button on wall by entrance door).

CAUTION

Ensure unsafe condition(s) have been rectified prior to performing procedures in paragraph 7.4.

7.4 Reactivation/Purge - Goodfellow AFB, Texas. If emergency shutdown was initiated while burners were operating, LPG will be trapped in lines from the ground control stand manifold to individual burner emergency shutdown valves. These lines shall be purged prior to troubleshooting/maintenance actions. To purge the system the Ignition Team will:

- a. In control tower third floor, pull the control panels emergency shutoff.
- b. Pull emergency shutdown control button on the ground control stand.
- c. Position appropriate ignitor switch to the ON position.
- d. Open appropriate individual burner

control valve which will allow excess LPG to purge and burn off from the control stand manifold to the mock-up.

- e. Close appropriate individual burner control valve.
- f. Position appropriate ignitor switch to the OFF position.

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS WARM WEATHER OPERATING PROCEDURES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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None

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None

FOREWORD

This work package contains setup and operating procedures for the Crash Fire Rescue Training Facility (CFRTF). These procedures include pre-exercise

inspection, pre-exercise setup, training exercise, and system shutdown and clean up.

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to extremely high temperatures, open flames, liquid propane vapor and fumes, and hot surfaces. It is imperative to wear appropriate protective clothing and to be aware of the EMERGENCY PROCEDURES in Work Package 004 00, paragraphs 6 and

7. High voltage will be present at burn area ignitors. All personnel shall remain clear of ignitors while in use. Failure to comply may cause serious injury. Use of Self Contained Breathing Apparatus (SCBA) is required for all fires. Exposed skin areas may result in burns by heat/steam.

Reference Material Required

None

1. PRE-EXERCISE INSPECTION.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury or death to personnel.

CAUTION

- The entire training facility is a no smoking area.
- Ensure propane tank level is sufficient for scheduled training exercise. Reservice tank, as required.

NOTE

- Pre-exercise procedures shall be performed by authorized personnel immediately prior to commencement of training exercise.
- Expansion joint bolts on mock-up are to remain loose through joint holes.
- a. Inspect burn area. Ensure rock plane is level. Ensure rock level is 1/2 inch to 1 inch below top of burn area drain. Inspect burn area drain valve for freedom of operation and absence of obstructions. Inspect exterior and interior burners and ignitors and ensure that burner grates are not excessively corroded and ignitor protectors are in place. Inspect aircraft mock-up for excessive corrosion. Inspect mock-up doors for freedom of operation and excessive corrosion. Inspect fuel and water piping for excessive corrosion.

- b. Inspect driving area around burn area for ruts. Level all ruts before proceeding.
- c. On electrical panel, inspect exterior lighting for proper operation, if applicable.
- d. Inspect propane system to include tank, gauges, valves, piping, nitrogen or manual safety system, and regulators for excessive corrosion, wear, or serviceability. Inspect for leaks or suspected leaks by using leak-tek or a sudsy liquid at joints and connections. Notify appropriate personnel to repair leaks before proceeding with any training exercise.
- e. Inspect control stand electrical, piping, valves, and regulators. Ensure that all valves are closed and all switches are off. Examine for excessive corrosion, wear, or serviceable limits.
- f. Inspect water conservation pond area. Examine visible portion of liner for damage. Ensure sufficient water is available to complete training exercise. Remove debris that may cause damage to pump.
- g. On electrical service rack, position all main circuit breakers to ON.
- h. Open the appropriate water valves and apply power to water conservation pond pump and test for adequate water pressure. Close valves when testing is complete. Low water pressure may indicate pump malfunction or unseated pump housing.
- i. Inspect nitrogen bottle(s), gauge(s), valve(s) and line(s) for serviceability. Ensure adequate nitrogen pressure is available before operating facility.

2. PRE-EXERCISE SETUP.

CAUTION

The entire training facility is a no smoking area.

NOTE

- These procedures shall be performed by the following authorized personnel immediately prior to commencement of training exercise: Training Instructor In Charge, Safety Officer, and Ignition Officer.
- Ensure all personnel are internally and externally clear of mockup and burn pit area.
 - a. Configure mock-up for exercise scenario.
 - b. Ensure sufficient water is in water conservation pond.
 - c. Ensure all water pump circuit breaker(s) are in the ON position.
 - d. Ensure fire department connection is closed.
 - e. Ensure burn area drain valve is closed.
 - f. Ensure weir drain valve is open, if applicable.
 - g. Position master power switch to ON.
 - h. Ensure water manifold drain valve on control stand is closed, if applicable.
 - i. Position water conservation pond pump switch to ON.
 - j. Charge applicable nitrogen system for operation.
 - k. Open LPG manual discharge valve on propane tank.
 - l. Open all in-line LPG shutoff valve at manifold.

- m. Fill burn area to top of weir drain. Ensure flooded waters cover the area from side to side without covering ground ignitors.
- n. Verify flow to all water jackets.
- o. Set emergency shutdown switch to normal position.

NOTE

Tag and lock out valves and switches to any inoperable burners or ignitors.

- p. Ensure proper ignitor operation, by first depressing and holding the appropriate ignitor switch. Close valve and proceed to the next burner.
- q. Repeat above procedure while slowly opening the corresponding propane valve.

3. TRAINING EXERCISE.

WARNING

- Extremely high temperatures and hot surfaces will be encountered during training exercise. It is imperative to wear appropriate protective clothing and to locate and be familiar with the Emergency Procedures in Work Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury or death to personnel. SCBA shall be utilized for all exercises.
- While attempting to ignite fires, if flames are not present within a reasonable amount of time (15 seconds), close burner valve(s) and allow area to vent before attempting reignition. Failure to comply could pose a serious risk of explosive gas build up.
- Stop training exercise and position master power switch to OFF if firefighters extinguish any fires while LPG is flowing to burner(s).

WARNING

Ensure that water jackets are properly operating prior to igniting ground fires. Failure to comply will result in damage to equipment and pose a hazard to personnel.

NOTE

- The Training Instructor in Charge shall be in control of the training exercise. Dedicated radio communication shall be established between Ignition Officer, Training Instructor in Charge, and Safety Officer.
- The Training Instructor in Charge initiates, oversees, and terminates the training exercise.
- Actual exercise burn time will be determined by the Training Instructor in Charge. After manual control valves are closed fire will burn an additional 15 to 25 seconds.
 - a. At the prompt of the Training Instructor in Charge, ignite the appropriate burners by depressing and holding the appropriate ignitor switch and slowly opening the corresponding manual propane valve until flame is present. Repeat step until all required burners are ignited.
 - b. For flowing fuel scenario, open appropriate engine water valve(s) prior to igniting burners, if applicable.
 - c. Once training objectives have been achieved, close manual propane valve(s) on control stand.

4. SYSTEM SHUTDOWN AND CLEAN UP.

- a. Ensure all LPG manual control valves on LPG distribution rack are closed.
- b. Position all ignitor control switches to OFF.
- c. Position master power switch to OFF.
- d. Close LPG manual control valve on control stand.
- e. Close LPG manual control valve on propane tank.
- f. Close nitrogen system cylinders, if applicable.
- g. Open mockup sprinkler system control valves to cool and washout mockup. Close sprinkler system control valves after mockup has cooled off.
- h. Operate washdown and water jackets for one hour.

NOTE

If Aqueous Film Forming Foam (AFFF) is used during training, flush burn area for a minimum of 48 hours.

- i. Ensure that washout control switch on control stand is open. Flush burn area for at least 1 hour.
- j. Close washout control switch.
- k. Position all main circuit breakers to OFF on electrical service rack.
- l. Level drive around area.

SUBORDINATE WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS COLD WEATHER OPERATING PROCEDURES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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None

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None

FOREWORD

This work package contains setup and operating procedures for the Crash Fire Rescue Training Facility (CFRTF). These procedures include pre-exercise

inspection, pre-exercise setup, training exercise, and system shutdown and clean up.

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to extremely high temperatures, open flames, liquid propane vapor and fumes, and hot surfaces. It is imperative to wear appropriate protective clothing and to be aware of the EMERGENCY PROCEDURES in Work Package 004 00, paragraphs 6 and

7. High voltage will be present at burn area ignitors. All personnel shall remain clear of ignitors while in use. Failure to comply may cause serious injury. Use of Self Contained Breathing Apparatus (SCBA) is required for all fires. Exposed skin areas may result in burns by heat/steam.

Reference Material Required

Publication Number
WP 007 00

1. PRE-EXERCISE INSPECTION.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury or death to personnel.

CAUTION

- The entire training facility is a no smoking area.
- Ensure propane tank level is sufficient for scheduled training exercise. Reservice tank, as required.

NOTE

- Pre-exercise procedures shall be performed by authorized personnel immediately prior to commencement of training exercise.
- Expansion joint bolts on mock-up are to remain loose through joint holes.
 - a. Inspect burn area. Inspect engines and interior burners and ignitors and ensure that burner piping/components are not excessively corroded and ignitor protectors are in place. Inspect aircraft mock-up for excessive corrosion. Inspect mock-up doors for freedom of operation and excessive corrosion. Inspect fuel piping for excessive corrosion.

NOTE

- Ground, wheel well, and APU burners will not be used during cold weather operations. They are expected to be under ice and not operational.
- Only engine and interior burners will be used during winter operations.
 - b. Inspect driving area around burn area for ruts. Level all ruts before proceeding.
 - c. On electrical panel, inspect exterior lighting for proper operation, if applicable.
 - d. Inspect propane system to include tank, gauges, valves, piping, nitrogen or manual safety system, and regulators for excessive corrosion, wear, or serviceable limits. Call appropriate personnel to repair leaks before proceeding with any training exercise.
 - e. Inspect control stand electrical, piping, valves, and regulators. Ensure that all valves are closed and all switches are off. Examine for corrosion, wear, and serviceable limits. Ensure seismic sensor for serviceable condition, if applicable. If sensor is tripped, site should be inspected for possible damage.
 - f. On electrical service rack, position all main circuit breakers to ON.
 - g. Inspect nitrogen bottle(s), gage(s), valve(s) and line(s) for serviceability. Ensure adequate nitrogen pressure is available before operating facility.

2. PRE-EXERCISE SETUP.

CAUTION

The entire training facility is a no smoking area.

NOTE

- These procedures shall be performed by the following authorized personnel immediately prior to commencement of training exercise: Training Instructor In Charge, Safety Officer, and Ignition Officer.
- Ensure all personnel are internally and externally clear of mockup and burn pit area.
 - a. Configure mock-up for exercise scenario.
 - b. Position master power switch to ON.
 - c. Pre-charge nitrogen system to 20 to 80 psi, if applicable.
 - d. Open LPG manual discharge valve on propane tank.
 - e. Open manual LPG shut off valve on control stand.

NOTE

Tag and lock out valves and switches to any inoperable burners or ignitors.

- f. Ignite the appropriate burners by first depressing and holding the appropriate ignitor switch while slowly opening the corresponding propane valve and ensure that adequate flame is present.

3. TRAINING EXERCISE.

WARNING

- Extremely high temperatures and hot surfaces will be encountered during training exercise. It is imperative to wear appropriate protective clothing and to locate and be familiar with the Emergency Procedures in Work Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury or death to personnel. SCBA shall be utilized for all exercises.
- While attempting to ignite fires, if flames are not present within a reasonable amount of time (15 seconds), close burner valve(s) and allow area to vent before attempting reignition. Failure to comply could pose a serious risk of explosive gas build up.
- Stop training exercise and position master power switch to OFF, if firefighters extinguish any fires while LPG is flowing to burner(s).

NOTE

- The Training Instructor in Charge shall be in control of the training exercise. Dedicated radio communication shall be established between Ignition Officer, Training Instructor in Charge, and Safety Officer.
- The Training Instructor in Charge initiates, oversees, and terminates the training exercise.
- Preburn time will not exceed 15 seconds. Actual exercise burn time will be determined by the Training Instructor in Charge. After manual control valves are closed fire will burn an additional 15 to 25 seconds.
 - a. At the prompt of the Training Instructor in Charge, ignite the appropriate burners by depressing and holding the appropriate ignitor switch slowly opening the corresponding manual propane valve until flame is present. Repeat step until all required burners are ignited.

- b. Once training objectives have been achieved, close manual propane valve(s) on control stand.

4. **SYSTEM SHUTDOWN AND CLEAN UP.**

- a. Ensure that all LPG manual control valves on LPG distribution rack are closed.
- b. Position all ignitor control switches to OFF.
- c. Position master power switch to OFF.

- d. Close LPG manual control valve on control stand.
- e. Close LPG manual control valve on propane tank.
- f. Close nitrogen system cylinders, if applicable.
- g. Position all main circuit breakers to OFF on electrical service rack.
- h. Level drive around area. Unattended ruts may upset Aircraft Rescue Fire Fighting vehicles (ARFF).

SUBORDINATE WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS

THULE AB OPERATING PROCEDURES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY, THULE AB GREENLAND

**THIS SUBORDINATE WORK PACKAGE RESERVED FOR THULE AIR BASE,
GREENLAND, OPERATING PROCEDURES**

SUBORDINATE WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS GOODFELLOW AFB OPERATING PROCEDURES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY, GOODFELLOW AFB TEXAS

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LIST OF ILLUSTRATIONS

None

LIST OF TABLES

None

FOREWORD

This work package contains setup and operating procedures for the Crash Fire Rescue Training Facility (CFRTF). These procedures include pre-exercise

inspection, pre-exercise setup, training exercise, and system shutdown and clean up.

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to extremely high temperatures, open flames, liquid propane vapor and fumes, and hot surfaces. It is imperative to wear appropriate protective clothing and to be aware of the EMERGENCY PROCEDURES in Work Package 004 00, paragraphs 6 and

7. High voltage will be present at burn area ignitors. All personnel shall remain clear of ignitors while in use. Failure to comply may cause serious injury. Use of Self Contained Breathing Apparatus (SCBA) is required for all fires. Exposed skin areas may result in burns by heat/steam.

Reference Material Required
None

1. RESPONSIBILITIES.

1.1 Ignition Team:

- a. Shall be responsible for performing the pre-exercise inspection and setup.

1.2 Training Instructor in Charge:

- a. Shall have sole responsibility for the training exercise, to include all students, instructors and equipment.
- b. Shall have dedicated radio communications with the Safety Officer and Ignition Team.
- c. Shall pre-brief, assign personnel duties, initiate, oversee, evaluate, terminate, and de-brief the training exercise.

1.3 Safety Officer:

- a. Shall ensure the control tower has been properly configured for emergency shutdown and normal operation.
- b. Shall ensure the Ignition Team has properly configured the control stand, for emergency shutdown and normal operation.
- c. Shall report to the training officer in charge that the training exercise may commence.
- d. Shall monitor the training evolution.

2. PRE-EXERCISE INSPECTION/SETUP.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury or death to personnel.

CAUTION

- The entire training facility is a no smoking area.
- Ensure propane tank level is sufficient for scheduled training exercise. Use adjacent small tank or reservice as required.

NOTE

- Pre-exercise inspection/setup shall be performed by the following authorized personnel immediately prior to commencement of training exercise: Training Instructor in Charge, Safety Officer, and Ignition Team.
- Ensure all personnel are clear of mock-up and burn area.
 - a. In the control tower second floor, ensure all circuit breakers are in the on position, and visually inspect the air compressor and filter/dryer for excess corrosion, wear, and serviceability.
 - b. In the control tower third floor, pull (open) the propane tank emergency shutoff and control panels emergency electrical shutoff buttons.

- c. Insert keys into selected mock-up control panel master switches and activate. If jet fuel will be used in the helicopter and/or the LFA, insert the JP-8 key(s) into the control panel master switches and activate. Pull (open) the emergency shutdown control button on the control stand.
- d. Push the JP-8 master electrical switch located on the third floor wall when JP-8 is required for training.
- e. Inspect the propane storage tanks, associated gauges, piping and valves for excessive corrosion or obvious damage.
- f. Take tank level readings as required from selected propane storage tank. Accurate tank level readings can only be obtained utilizing the tank Roto Gauge. To read the gauge, (1) open the petcock valve on the end of the gauge, (2) turn the gauge lever to the left or right slowly until LPG escapes through the open petcock. The corresponding reading on the gauge under the lever is the percentage of LPG in the storage tank. Return the lever to the 12 o'clock position. and allow excess LPG to bleed off. Close the petcock valve.
- g. Open selected propane storage tank manual liquid supply valve. Open valve (1A) if utilizing tank A, or (1B) if utilizing tank B.
- h. Open selected propane storage tank manual vapor return valve. Open valve (2A) if utilizing tank A, or (2B) if utilizing tank B.
- i. Ensure valves 3, 4, 5, and 6 are in the open position on the associated piping.
- j. If jet fuel fires are planned during training, visually ensure the JP-8 master power switch located near the JP-8 storage tank is on.
- k. Ensure the JP-8 OS&Y supply valve, located near the storage tank, is open (approximately 2 inches of threads showing above handle).
- l. Inspect the JP-8 storage tank, associated gauges, piping and valves for excessive corrosion or obvious damage.
- m. Inspect the control stand/mock-up to include electrical and mechanical components, piping, valves, regulators, and nitrogen system.
- n. Inspect burn area. Ensure rock is level and that when flooded, water covers entire pit from side to side without covering ground ignitors.
- o. Ensure that rock level is 1/2 inch to 1 inch below top of burn area drain and level throughout the pit.
- p. Ensure burn area drain valve inside weir is closed and weir drain valve outside of weir is open.
- q. Inspect exterior and interior burners and ignitors and ensure that burner grates are not excessively corroded and ignitor protectors are in place.
- r. Inspect mock-up for excessive corrosion. Inspect all doors for freedom of operation and excessive corrosion.
- s. Inspect fuel, water piping and water jackets for excessive corrosion.
- t. Inspect exterior lighting for proper operation, if applicable.
- u. Open water jacket(s) manual control valve on the control stand. Ensure water continuously flows to all water jackets on the mock-up.
- v. Ensure nitrogen system vent valve next to cylinder(s) is closed and the 2 in-line valves above cylinder(s) are closed. Open (counter clockwise) nitrogen valve on top of nitrogen cylinder. A minimum of 500 psi is required in the cylinders to ensure emergency shutdown and nitrogen valves work properly.
- w. Turn on washout system timer switch and bring water level to top of weir drain. Select desired time as required. Turn washout off when water level begins to flow into weir drain.

- x. Perform operational check on all ignitors by activating the appropriate ignitor switch.
- y. Repeat procedure by slowly opening the corresponding manual propane valve until fully open. If flame height is inadequate for training purposes due to low temperatures, turn the LPG transfer pump master switch on and position the transfer pump control switch to the automatic position. Close valve 3. Close manual propane valve and repeat for all burners to be utilized.

3. TRAINING EXERCISE.

WARNING

- Extremely high temperatures and hot surfaces will be encountered during training exercise. It is imperative to wear appropriate protective clothing and to locate and be familiar with the Emergency Procedures in Work Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury or death to personnel. SCBA shall be utilized for all exercises.
- While attempting to ignite fires, if flames are not present within a reasonable amount of time (15 seconds), close burner valve(s) and allow area to vent before attempting reignition. Failure to comply could pose a serious risk of explosive gas build up.
- Stop training exercise and position master power switch to OFF, if firefighters extinguish any fires while LPG is flowing to burner(s).

NOTE

The Training Instructor in Charge shall confirm all Pre-Exercise Inspection and Set Up procedures have been completed by the Ignition Team and Safety Officer.

- a. Open the control stand manual shut off propane valve.

- b. Ignite selected burners by activating the appropriate ignitor switch and slowly opening the corresponding manual propane valve until fully open. Repeat step until all required burners are ignited.
- c. For running fuel fires, open the JP-8 supply ball valve on the ground control stand.
- d. Set the fuel meter by pushing the set button until it latches.
- e. Set the gallon amount for dispensing (gallons and tenths).
- f. Cock the meter valve handle.
- g. Select the desired engine and open the appropriate ball valve.
- h. Ignite the selected engine using LP procedures in step b of this section.
- i. Activate the JP-8 solenoid (white) dispense button. Once the jet fuel is ignited, shutdown the propane burner in accordance with normal procedures. Repeat as desired.
- j. Once the fuel meter flow has stopped, deactivate the JP-8 solenoid by pressing the white button.

3.1 Exercise Shutdown Procedures:

- a. Close manual propane valve(s) on control stand.
- b. Turn the ignitor switches off.
- c. If jet fuel burning is complete, close the JP-8 supply valve and the engine supply valve.
- d. Shut off the JP-8 transfer pump switch located in the control tower.

4. SYSTEM SHUTDOWN AND CLEAN UP.

When training on a specific mock-up is complete, the Training Instructor in Charge shall direct the Ignition Team to:

- a. Close the control stand master propane valve. Flare off all gas in the propane manifold by activating the corresponding ignitor while opening a manual propane valve.
- b. Once fire has burned out, ensure all manual propane valves on the LPG distribution rack are closed.
- c. Position all ignitor control switches to OFF.
- d. Position emergency shutdown switch on control stand to OFF.
- e. Ensure water jacket control valve remains open while mock-up cools (approximately one hour).
- f. Close nitrogen system cylinder valve. Close the second in-line valve above the cylinder(s). Open drain valve next to cylinder(s). When pressure is relieved, close drain valve and first in-line valve.
- g. In control tower third floor, turn off master switch key for the appropriate mock-up and

push emergency shutdown button on control panel. If JP-8 was utilized, turn off the JP-8 master switch key for the appropriate mock-up and turn off the JP-8 master electrical switch (push button located on the north east interior wall).

- h. Activate washout system control valve in control tower to flush burn area. Set washout timer for a minimum of one hour.

NOTE

At end of training day the Ignition Team will perform steps i through m.

- i. Ensure master electrical switch for JP-8 is closed (pushed in).
- j. Push (close) propane tank emergency shutoff and control panel emergency electrical shutoff buttons.
- k. Close selected propane storage tank manual liquid supply valve. Close valve (1A) if utilizing tank A, or (1B) if utilizing tank B.
- l. Close selected propane storage tank manual vapor return valve. Open valve (2A) if utilizing tank A, or (2B) if utilizing tank B.
- m. Turn off master switch keys for all mock-up control panels.

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS
QUARTERLY SYSTEM SAFETY INSPECTION

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

LIST OF EFFECTIVE WP PAGES

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None

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None

FOREWORD

This work package contains quarterly system safety inspection procedures for the Crash Fire Rescue Training Facility (CFRTF). Most items will be inspected by base Civil Engineering shops designated by the base

Civil Engineer. These procedures include steps necessary to inspect the entire facility. Items that do not pass inspection will be repaired or replaced by base Civil Engineering.

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to liquid propane vapor and fumes. It is imperative to be aware of the EMERGENCY PRO-

CEDURES in Work Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury.

Reference Material Required

None

1. QUARTERLY SYSTEM SAFETY INSPECTION.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to comply may cause injury or death to personnel.

CAUTION

The entire training facility is a no smoking area.

NOTE

- The Quarterly System Safety Inspection procedures shall be performed by authorized personnel.
- Expansion joint bolts on mock-up are to remain loose through joint holes.
 - a. Inspect burn area. Ensure rock is level so when flooded a continuous film of water covers area from side to side. Ensure that rock level is 1/2 inch to 1 inch below top of burn area drain.
 - b. Inspect burn area drain valve and weir drain valve for freedom of operation and absence of obstructions.
 - c. Inspect exterior and interior burners and ensure that burner grates are not excessively corroded or warped and that ignitor protective covers and burner baffles are in place.
 - d. Inspect ignitors and ensure electrode is clean and ceramic insulator is not cracked or damaged.
- e. Inspect aircraft mock-up for excessive corrosion and structural integrity.
- f. Inspect mock-up doors for freedom of operation and excessive corrosion.
- g. Inspect dual liner leak detection point, if applicable, for evidence of liner leaks. Some accumulation of liquid may be present due to normal rate of condensation.
- h. Inspect exterior lighting for proper operation.
- i. Inspect propane system to include tank, gages, valves, piping, nitrogen or manual safety system, and regulators for corrosion, wear, or serviceable limits.
- j. Inspect control stand to include electrical and mechanical components, piping, valves, and regulators. Check for corrosion, wear, or serviceable limits. Inspect markings on valves and switches for legibility.
- k. Inspect water conservation pond area. Examine visible portion of liner for damage.
- l. Open the washout, sprinkler, and engine water valves and then apply power to water conservation pond pump and test for adequate operation and water pressure. Close all valves when testing is complete.
- m. Charge applicable nitrogen systems for operation and examine for leaks.
- n. Ensure nitrogen system and emergency shut-off valve are functioning properly.

NOTE

Refer to flammable gas detector operators manual prior to performing this step.

o. Pressurize propane piping for one (1) hour and examine valves for leaks at burners with flammable gas detector.

p. Inspect cathodic system annually, if applicable.

q. Inspect driving area around burn area for ruts. Level all ruts before proceeding.

r. Obtain water sample for environmental testing at washout.

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS WINTERIZATION PROCEDURES

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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FOREWORD

This work package contains winterization procedures for the Crash Fire Rescue Training Facility (CFRTF).

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to liquid propane vapor and fumes. It is imperative to be aware of the EMERGENCY PRO-

CEDURES in Work Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury.

Reference Material Required

Publication Number
WP 006 00

1. WINTERIZE.

WARNING

If an obvious unsafe condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury.

CAUTION

The entire training facility is a no smoking area.

NOTE

- Winterization procedures shall be performed by authorized personnel.
- No vehicles are allowed in burn area.
- Perform quarterly inspection IAW WP 006 00 prior to performing these procedures.
 - a. Flush burn area for not less than 1 hour.
 - b. Open the burn area drain valve (Figure 1), weir drain valve, water manifold drain valve, trench drain valve and fire department connection. These valves must remain open to drain for not less than 72 hours.
 - c. Remove water pump from the water conservation pond and place in storage, if applicable.
 - d. Tag and seal closed all ignitor switches and propane valves used to control ground burners, APU, and wheelwell. Tag and seal closed the washout switch on the electrical control bank.

- e. Visually verify all water has drained from burn area and close the burn area drain valve, the weir drain valve, the fire department connection and water manifold drain valves.

2. DE-WINTERIZE.

WARNING

If an obvious unsafe condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury.

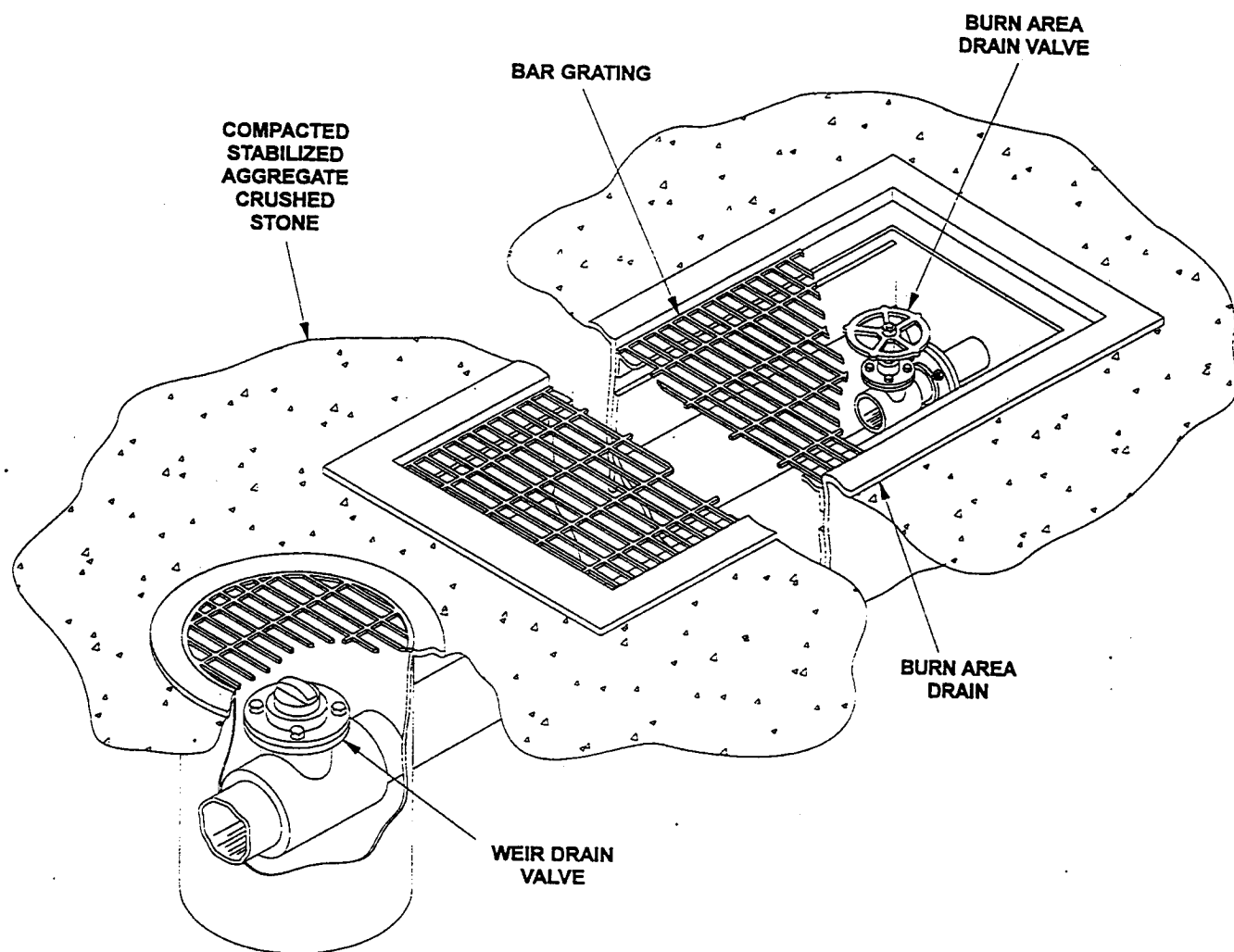
CAUTION

The entire training facility is a no smoking area.

NOTE

- De-winterization procedures shall be performed by authorized personnel.
- No vehicles are allowed in burn area.
 - a. Install water pump, seat seal, and operationally checkout pump.
 - b. Ensure fire department connection, water manifold drain valve, and burn area drain valve are closed.
 - c. Turn on main circuit and appropriate breakers for water pump.
 - d. Remove seals from ground ignitors, APU, wheelwell, and washout switches on electrical control bank.

- e. Open trench drain valve and weir drain valve.
- f. Open engine and sprinkler system valves.
- g. Operate washout pump for one hour and flush burn area.
- h. Remove lockouts.
- i. Perform quarterly system safety inspection in accordance with WP 006 00.



FP1A1B5A

Figure 1. Burn Area Drain

WORK PACKAGE

OPERATION AND MAINTENANCE INSTRUCTIONS MAINTENANCE AND FACILITY OVERVIEWS

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

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FOREWORD

This work package contains theory of operations for the Crash Fire Rescue Training Facility (CFRTF).

SAFETY SUMMARY

None

Reference Material Required

Publication Number
SWP 008 01

1. THEORY OF OPERATION - GENERAL.

This theory of operation is based on the generic design. Individual site configurations may vary. The Crash Fire Rescue Training Facility (CFRTF) consists of an aircraft mock-up, burn area, control stand, liquid propane fuel system, cathodic protection system and water conservation pond. Refer to figure 1 for specific site configurations. General maintenance procedures are described in SWP 008-01.

The aircraft mock-up, located in the burn area, is constructed of uncoated/unpainted carbon steel. It is approximately 72 feet long, 25 feet high at tip of tail, with a wingspan of 72 feet. The mock-up is configured with three simulated aircraft engines, two on the right wing and one located on the vertical stabilizer. Each engine contains one burner assembly and two ignitors. The wiring to the engine ignitors is enclosed in a protective water jacket that protects it from possible failure due to extreme heat. Water injection is located in both wing engines and at some sites in the tail engine. The wing engines also have dams installed to simulate a flowing fuel type fire. Wheel well and auxiliary power unit fires are simulated on the right side of the fuselage adjacent to the inboard engine. In the interior of the mock-up, ignitors and burners are installed to simulate flight deck, battery box, passenger compartment, and cargo box fires. A water sprinkler system is installed in the top of the mock-up to cool and washout the mock-up. An expansion joint is located midway on the fuselage to allow for expansion and contraction during training. Cut-out panels are located on the left and right aft sides of the fuselage. These 36 inches x 84 inches replaceable panels are constructed of .031 inch thick sheet metal. The panels are used to simulate emergency entrance into an aircraft. Two steel hinged doors are located at the forward left and left amid ships.

The burn area is 100 feet in diameter. It is recessed and lined with either one or two 80 mil thick high density polyethylene (HDPE) liner(s). The liner(s) is sandwiched between 6 inch thick layers of sand and then covered by an 18 inch thick layer of 1-1/2 inch rock.

There are six ignitors and burners installed in the burn area to simulate exterior ground fires. They are located on the left and right sides of the forward fuselage, between the right wing engines, under the left wing, and on the left and right sides of the aft fuselage. The weir is used to maintain the proper water level in the burn area. Opening the burn area drain valve allows all the water in the burn area to drain to the water conservation pond.

Located on the control stand are the valves, regulators, solenoids and switches used to control the propane flow and ignitors during training events. Turning off the master/emergency switch located on the control stand will turn off power to all ignitors and close the internal valve located on the propane tank via the pneumatic control system, if applicable. The propane piping, water piping, and electrical conduits from the control stand to the burn area are located in an underground HDPE lined trench. Regulators are adjusted when propane flow at burners require increased or decreased pressure for flame sizing. There are no regulators for the ground burners. Burners are further equipped with high speed emergency shut off valves.

The liquid propane system supplies fuel for training exercises. Propane is supplied from a 10,000 water gallon tank to the various burners in the burn area through a series of pipes and valves. It is recommended to reservice the tank when 25% of its capacity remains. Reservicing propane requires a fire department representative to operate the nitrogen pneumatic system, if applicable. This will open a pneumatic valve on the servicing side of the tank allowing propane to flow from the servicing truck to the tank after manual wheel valves are positioned open. A vapor return line is recommended for faster servicing so that pressure remains equal or balanced. The tank should be reserviced to a level of 80% to 85%. Vapor pressure (Table 1) will vary with ambient temperature.

Table 1. Temperature and Pressure Relation.

AMBIENT TEMPERATURE	POUNDS PER SQUARE INCH (PSI)
100° Fahrenheit	196
70° Fahrenheit	127
0° Fahrenheit	30
-40° Fahrenheit	2

Flammability limits between vapor and liquid are very little. Liquid propane has a boiling point of -44° Fahrenheit. A propane pump may be installed to obtain adequate pressure, if applicable. Propane flow to each individual burner is controlled by a corresponding valve located on the control stand. Safety features of the propane system are provided to stop the flow of fuel to the burners, and will include a pneumatic or manual control system, seismic sensor, and an emergency shut-off valve located on the control stand. Pressure relief valves are installed on the piping as required by NFPA Standard 58. Cathodic protection system is used to protect below ground piping from corrosion through sacrificial anodes inside the trench from the control stand to the burn area.

A typical water conservation pond is a 72 feet x 72 feet square area, 9 feet deep. It is lined with either one or two layers of 80 mil thick HDPE. Unlike the burn area, the liner(s) is not covered. A pump located in the pond is used to supply necessary water for training area. Pump location may vary.

2. THEORY OF OPERATION GOODFELLOW AFB, TEXAS.

This theory of operation is based on a site specific design for Goodfellow AFB Crash Fire Rescue Training Facility (CFRTF). The CFRTF consists of five (5) fire training mock-ups and individual burn areas and ground control stands, a master control tower, liquid propane gas and JP-8 fuel supply systems, cathodic protection and a self contained water supply system. General maintenance procedures are described in SWP 008-01.

The Large Frame Aircraft (LFA) mock-up, is constructed of uncoated/unpainted carbon steel. It is approximately 72 feet long, 25 feet high at the tip of the tail and has a wing span of 75 feet. The mock-up has fifteen burners with dedicated ignitor(s). There are six ground burners surrounding the mock-up to simulate exterior ground fires. The burners are located on the left and right sides of the forward fuselage, between the right wing engines, under the left wing, and the left and right aft fuselage. The mock-up is configured with three simulated aircraft engines, two on the right wing and one on the vertical stabilizer on the tail. Each engine contains one burner assembly with two ignitors. Water sprinklers and water dams are installed in the wing engines. Three dimensional running fuel fires can be created by injecting JP-8 into the water flowing over the water dams which in turn allows JP-8 to flow on to the ground surrounding the engines. Wheel well and auxiliary power unit fires are simulated on the right side of the fuselage adjacent to the inboard engine. In the interior of the mock-up, ignitors and burners are installed to simulate flight deck, battery box, passenger compartment and cargo bay fires. A water sprinkler system is installed along the top of the interior to cool and washout the mock-up after training is complete. Replaceable sheet metal cut out panels are located on the left side of the mock-up. The panels are used to simulate emergency entrance into aircraft. Two hinged doors are located on the left side and one on the right side of the mock-up.

The Fighter mock-up is constructed of uncoated/unpainted carbon steel. The mock-up has six ground and one engine burner. Two are located forward of the left wing, two forward of the right wing, one left and one right on the rear of the mockup. The engine burner is accessible from the rear of the mock-up.

The Helicopter mock-up is constructed of uncoated/unpainted carbon steel. The mock-up has four ground burners. They are located front right and left and rear right and left of the fuselage. The mock-ups interior burners simulate an under dash battery fire and a rear wall cockpit fire. An additional burner is located in the engine stack and has both LPG and JP-8 fire capabilities.

The Tanker mock-up is constructed of uncoated/unpainted carbon steel. The mock-up has two ground burners, one at the rear and one under the center. There

are two burners located in the open tank accessible from the top of the mock-up, one in the dome tank and one on the left side piping assembly.

The Automobile mock-up is constructed of uncoated/unpainted carbon steel and has one ground burner on the rear of the vehicle. There are additional burners located in the engine compartment, passenger compartment and in the trunk.

Water jackets are installed on all ignitor units on all mock-ups with the exception of the ground burners. The water jackets cool and protect ignitor wiring assemblies. Each burner is equipped with an emergency shut down system. Any combination of burners may be utilized thus creating unlimited training scenarios.

The burn areas vary in size (LFA 150 feet in diameter, Fighter 75 feet in diameter, POL Tanker 75 feet in diameter, Helicopter 50 feet in diameter, and automobile 30 feet in diameter). The burn area is recessed and lined with an 80 mil thick high density polyethylene (HDPE) liner. The liner is back filled with a 6 inch layer of sand and then covered by 18 inches of 1-1/2 inch crushed aggregate. The burn area washout piping allows for water induction into the pit and for washout upon completion of training. The burn area weir drain allows water to return to the water recover and distribution system and for winterizing the facility, if required. Water leaving the burn area is recycled through a fuel/oil separator prior to recovery in the system water storage and distribution system.

A ground control stand is provided for operation of the mock-up. Located on the stand are various valves, regulators, solenoids and switches used to control LPG/JP-8 flow, ignition, emergency shutdown, and extinguishment during training exercises. A control panel displays all burner locations and corresponding ignition switches. An emergency shutdown control button located on the control panel will turn off power to all ignitors and close burner propane supply valves at the mock-up. The LPG/JP-8 and water piping, nitrogen tubing, and electrical conduit from the control stand to the burn area are located in an underground HDPE lined trench. Cathodic protection is installed to protect below ground piping from corrosion through sacrificial anodes. Fire size can be adjusted at individual regula-

tors for all mock-up burners. The six ground burners do not have regulators.

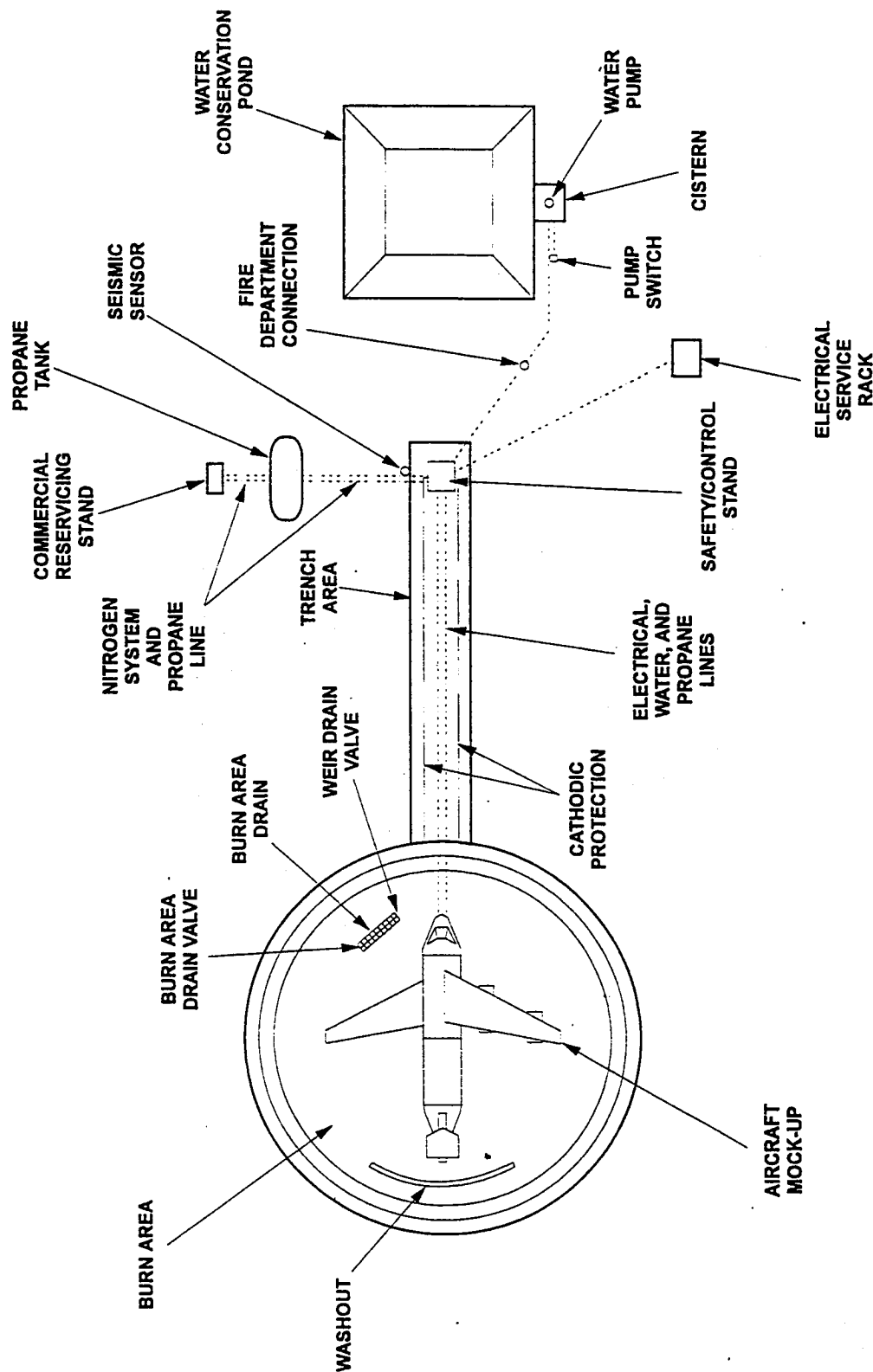
An LPG fuel system supplies fuel for training fires. LPG is stored in two independently operated tanks. Tank A has a capacity of 30,000 water gallons and tank B has a capacity of 10,000 water gallons. LPG is distributed to each ground control stand and burn area through a series of piping and valves. LPG is directed from the control stand to selected burners by individual manual control valves. Emergency shutdown safety features are incorporated at the ground control stand and the control tower for shutting off LPG flow and for shutting off electrical power. Propane expands 1.5% for each 10 degrees of increased temperature. As the temperature rises, the vapor pressure within the tank also rises accordingly. Propane has an octane rating of 125. It is recommended to reservice the tank(s) when 15% to 20% of capacity remains. Commercial vendors will reservice the tanks. The tank shall only be reserviced to 85% of capacity. LPG has a boiling point of minus 44 degrees Fahrenheit and flammability limits between vapor and liquid are minute. An LPG pump is available at the storage tanks for use in cold weather should tank pressure be inadequate for transferring LPG to the burn areas.

JP-8 fuel can be used alone or combined with LPG on the LFA right wing engine burners and on the helicopter stack burner. JP-8 is stored in a 5000 water gallon tank adjacent to the LPG storage tanks. JP-8 is distributed to the burners under the same operating principle as LPG. Once JP-8 has been distributed into the burners/ground area, the fuel will burn until extinguished and can not be terminated by emergency shutdown procedures.

A safety control tower located in the center of the training complex allows visual and audible communications with all 5 training mock-ups. The master switch for each mock-up control stand is activated on the corresponding tower control panel. JP-8, propane tank emergency shutoff, and the control panels emergency electrical shut off buttons are located on the third floor of the tower. An air compressor housed on the second floor of the tower provides air pressure for opening the LPG storage tank(s) emergency shutoff valves. The tower also houses various circuit breakers for the entire complex.

The water system is composed of a closed loop non potable distribution system. Water discharged into the burn area(s) is recycled through a fuel/oil separator and into a 500,000 gallon water storage tank. Three in-

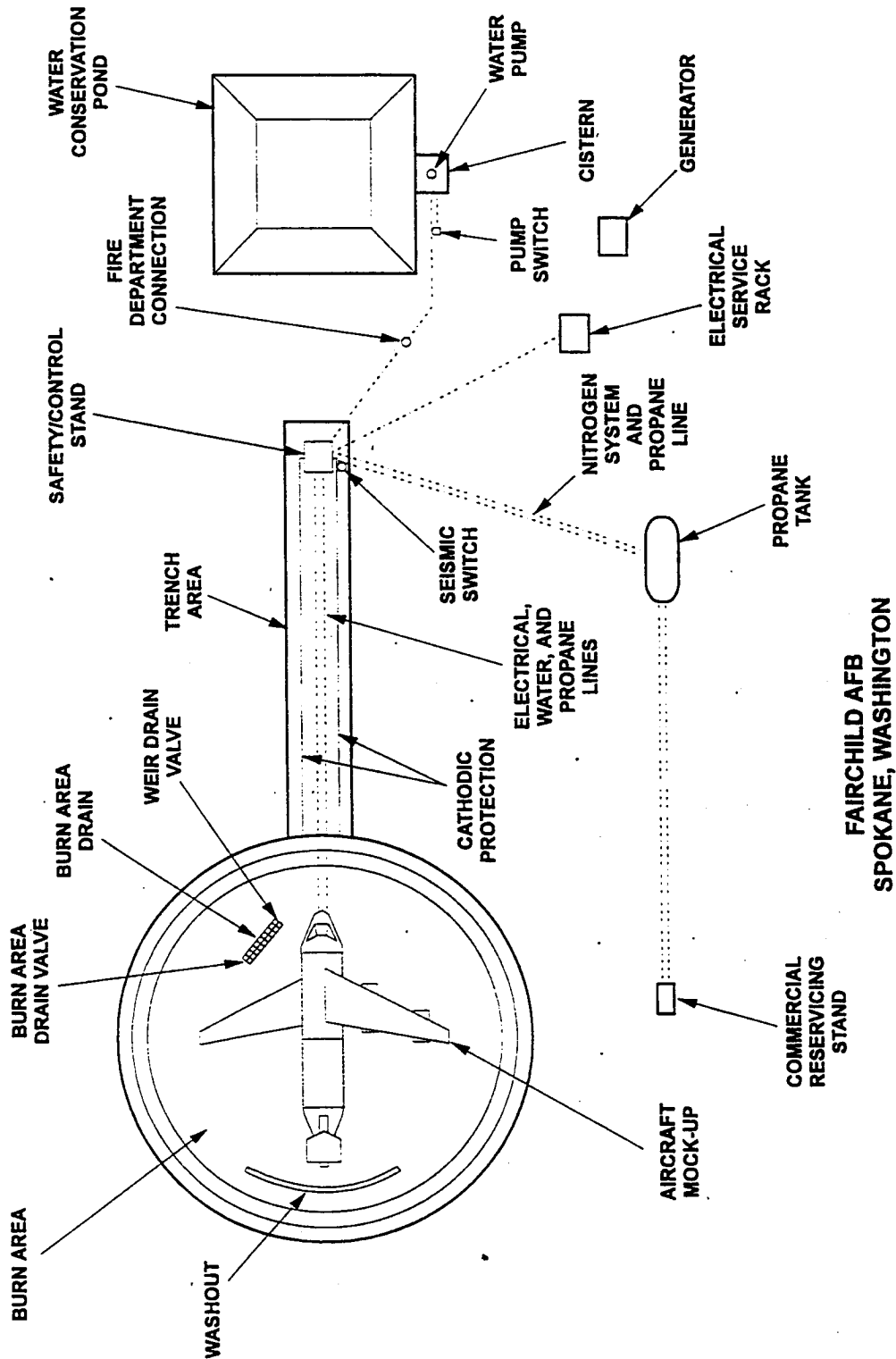
line pumps draw water from the storage tank into a 10,000 gallon hydro pneumatic pressure tank and fire hydrant system.



MALMSTROM AFB
GREAT FALLS, MONTANA

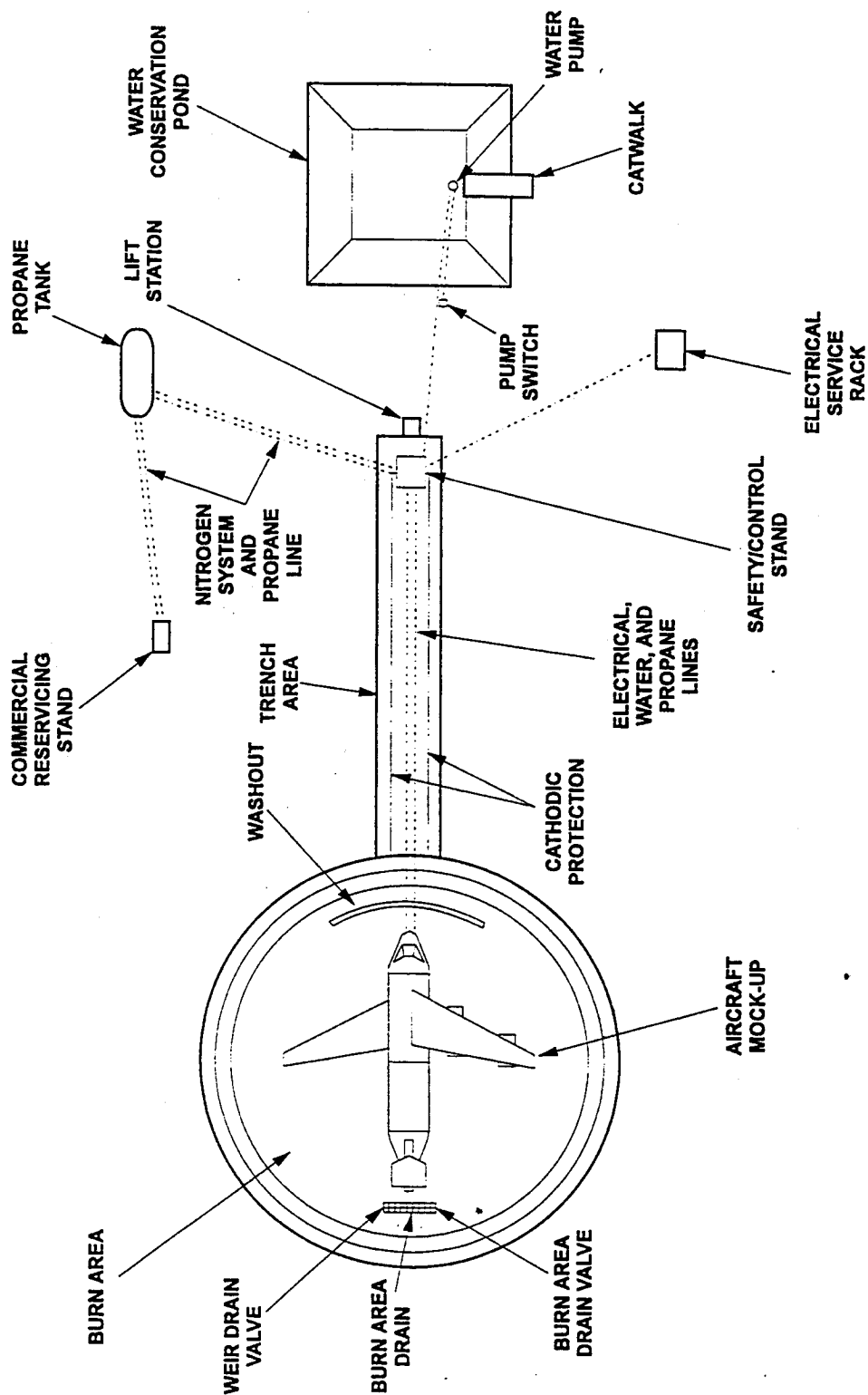
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Figure 1. Malmstrom Air Force Base



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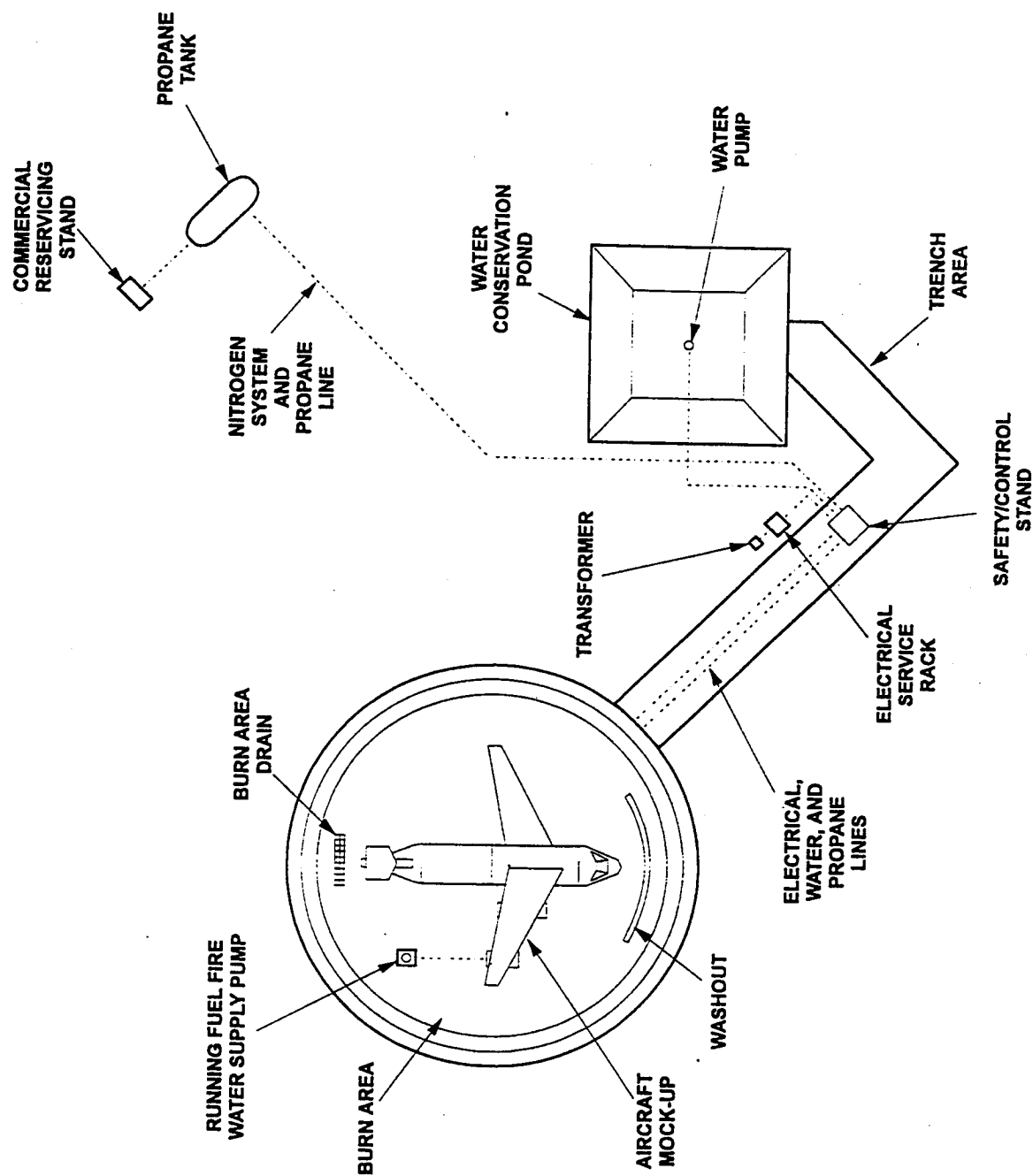
Figure 2. Fairchild Air Force Base



OFFUTT AFB
OMAHA, NEBRASKA

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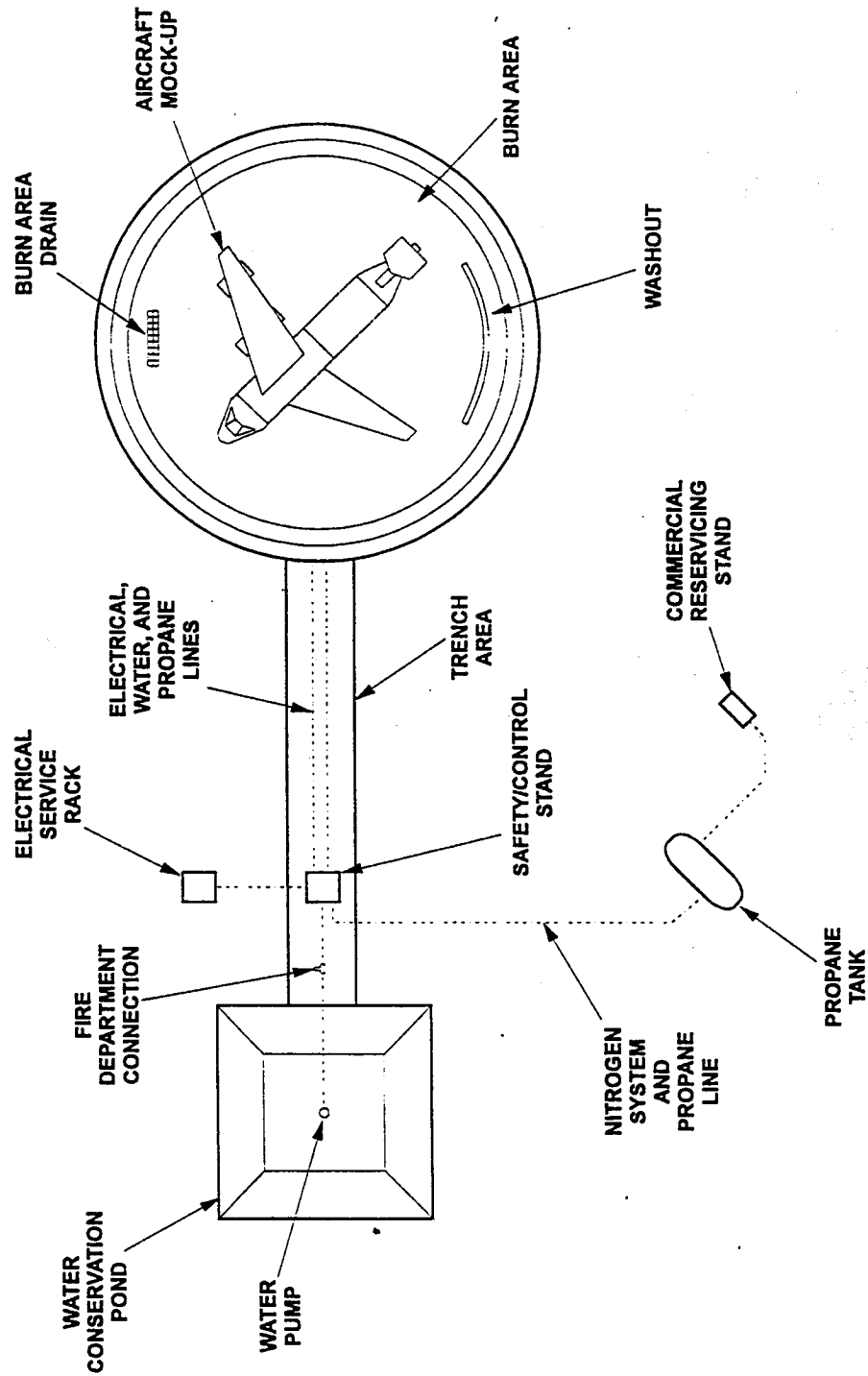
Figure 3. Offutt Air Force Base



VANCE AFB
ENID, OKLAHOMA

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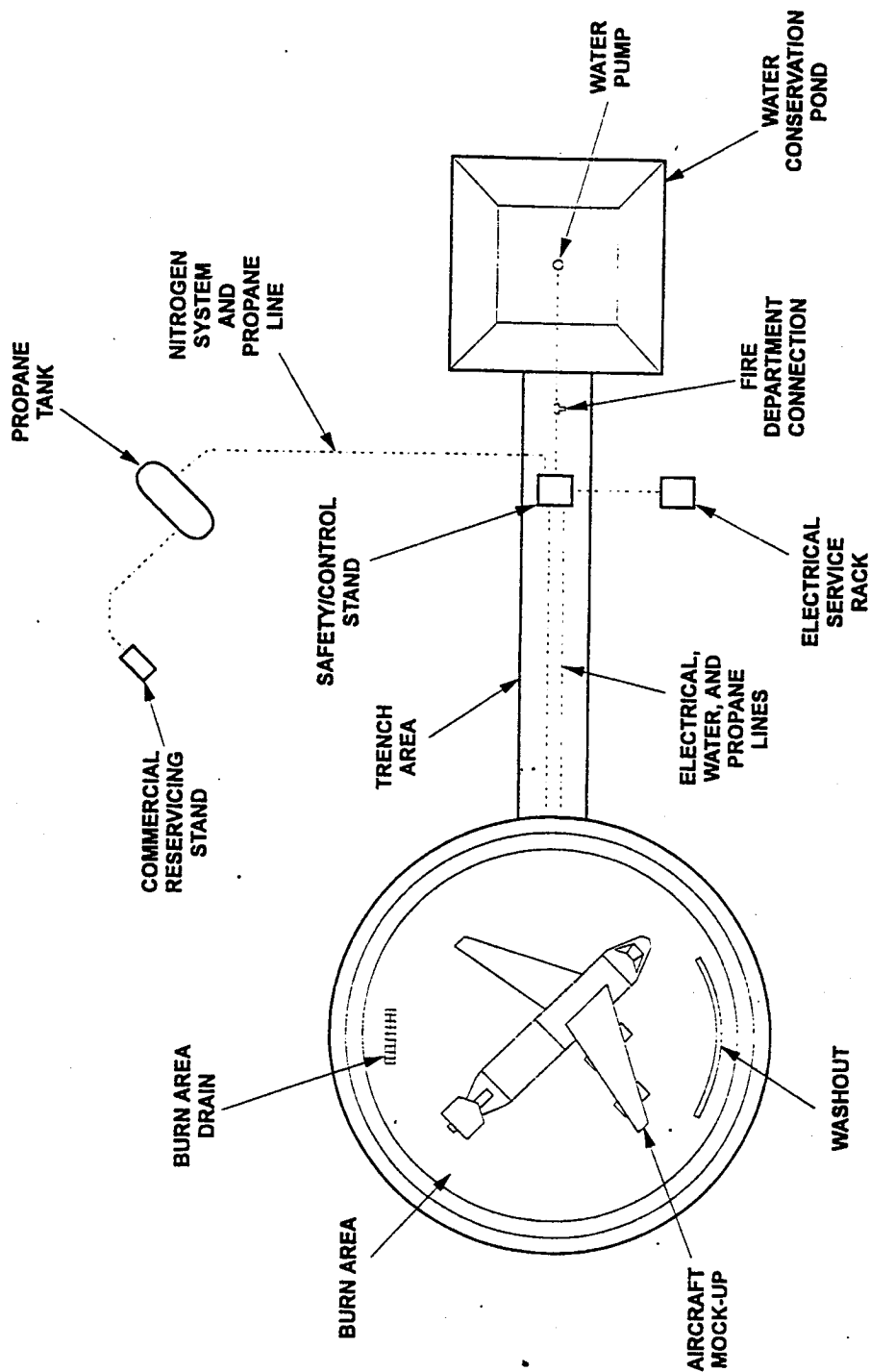
Figure 4. Vance Air Force Base



COLUMBUS AFB
COLUMBUS, MISSISSIPPI

FP1A1A9X

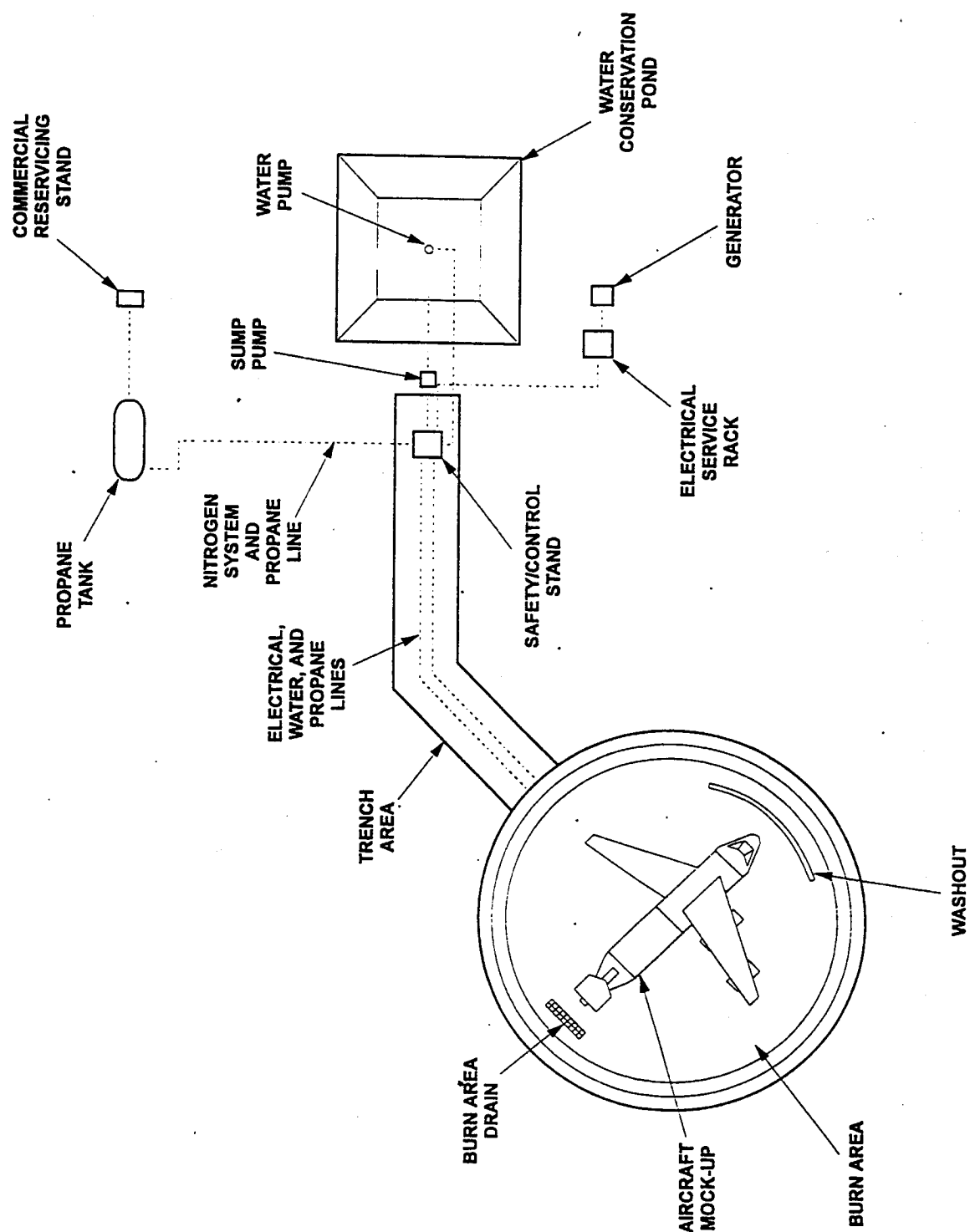
Figure 5. Columbus Air Force Base



TYNDALL AFB
PANAMA CITY, FLORIDA

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Figure 6. Tyndall Air Force Base



ANDREWS AFB
CAMP SPRINGS, MARYLAND

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Figure 7. Andrews Air Force Base

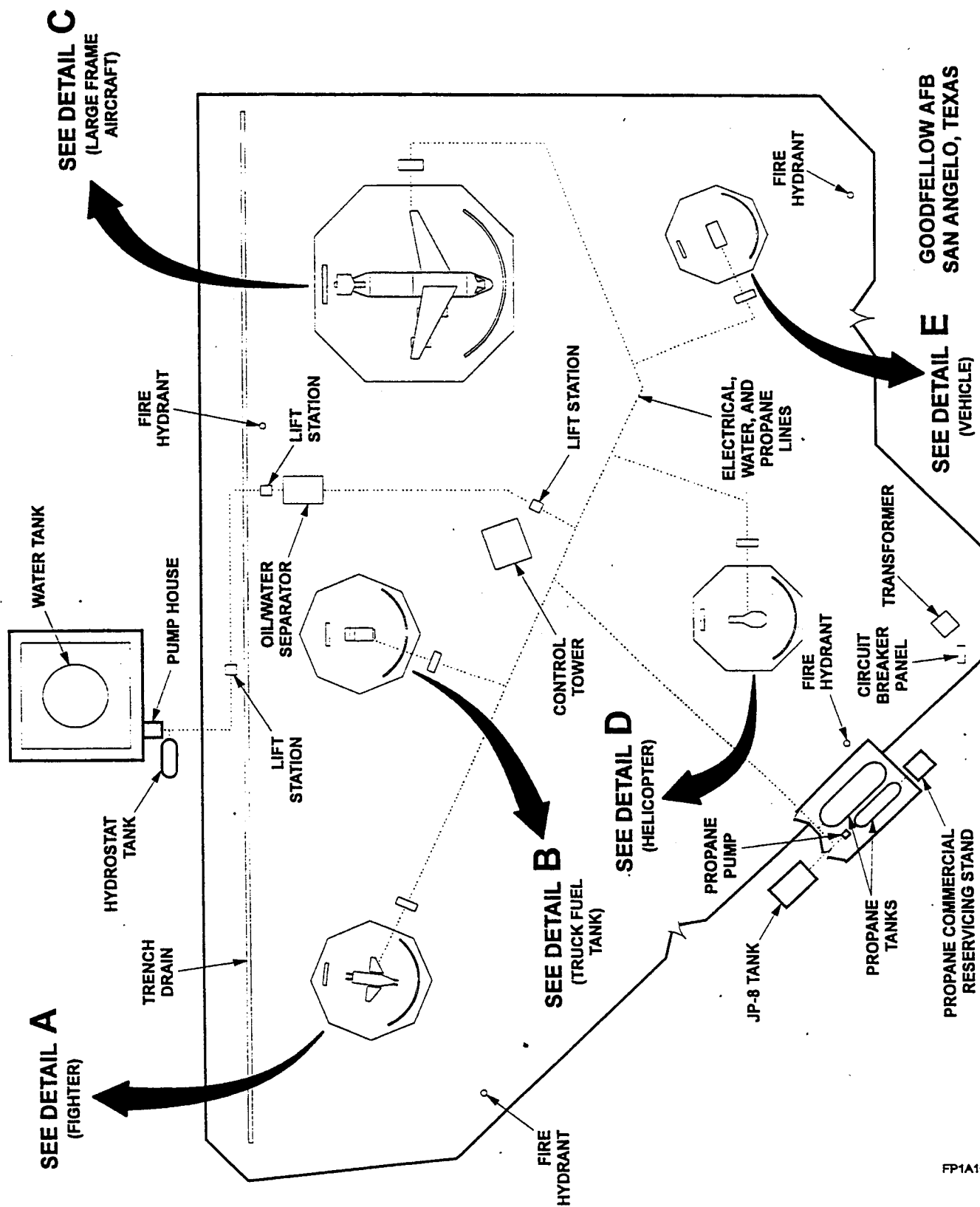
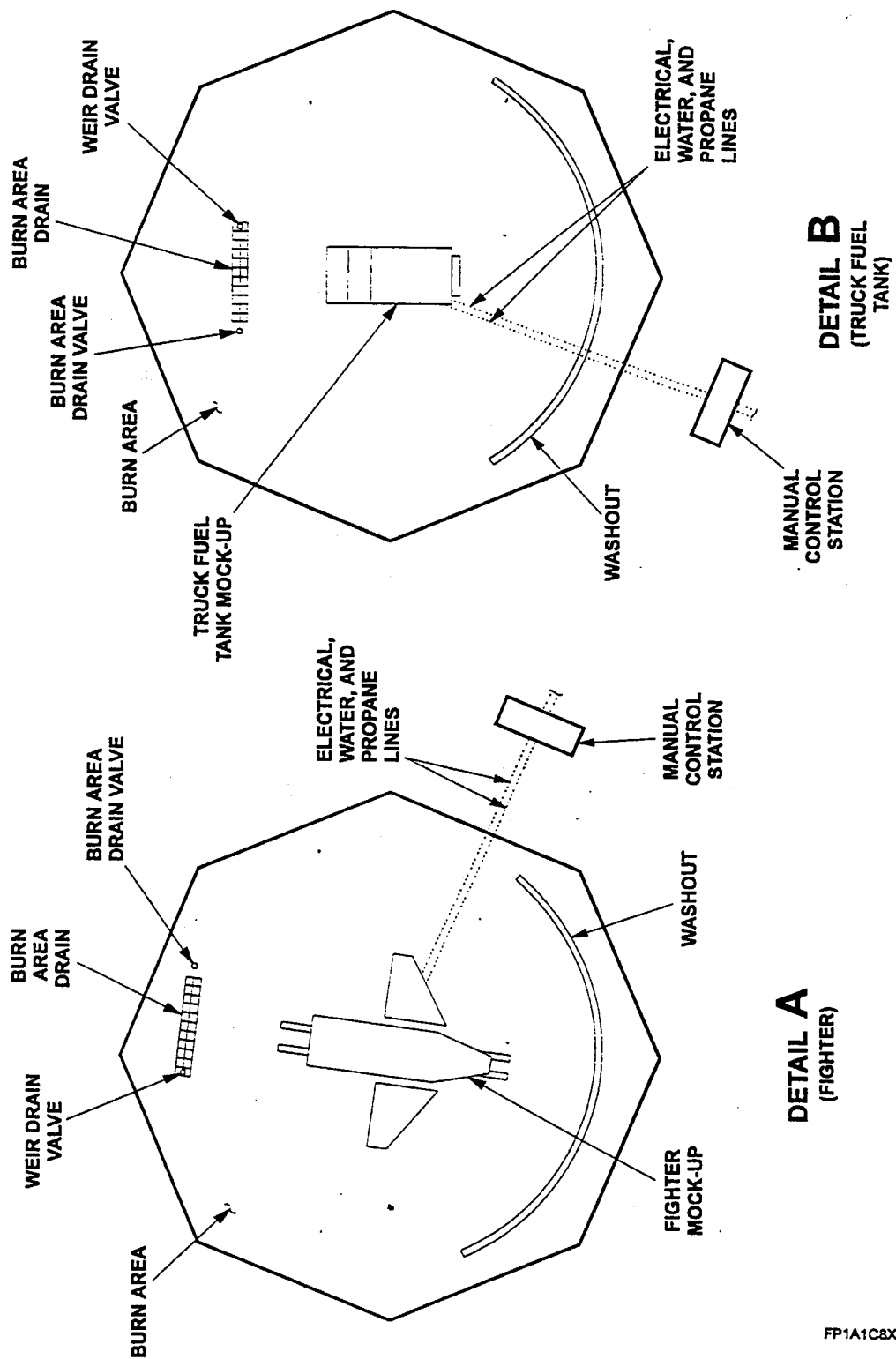


Figure 8. Goodfellow Air Force Base (Sheet 1 of 4)



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Figure 8. Goodfellow Air Force Base (Sheet 2 of 4)

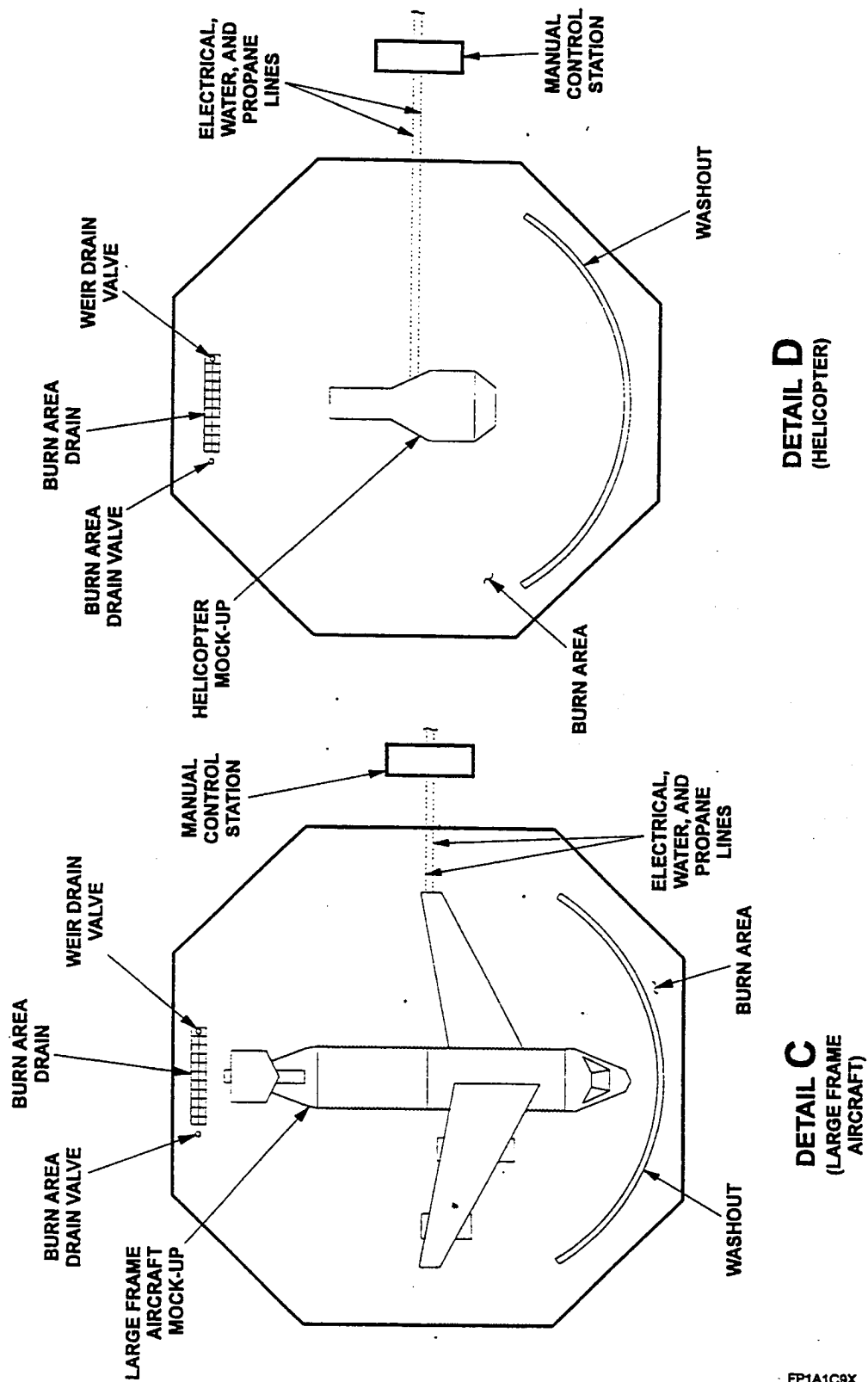
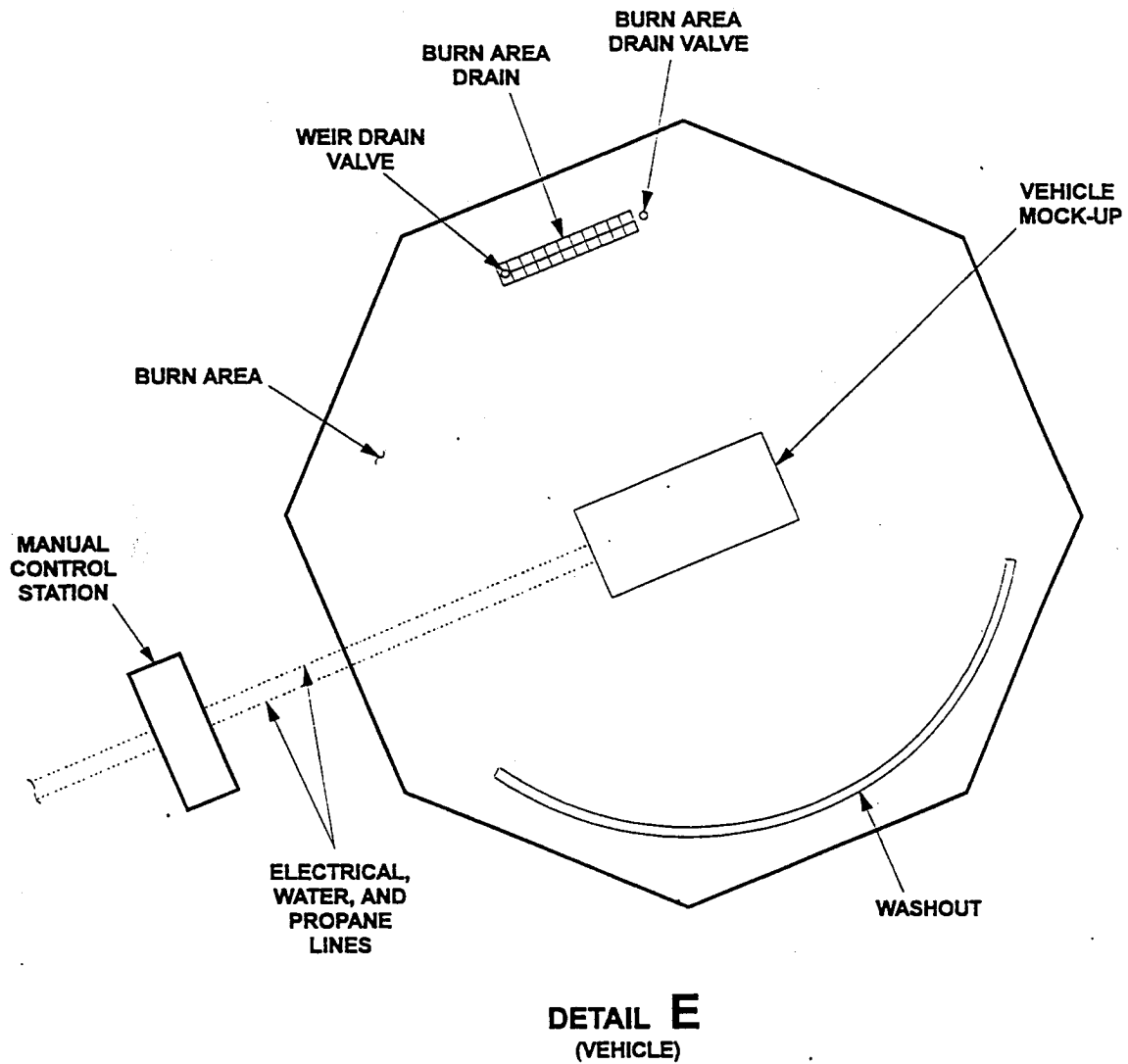
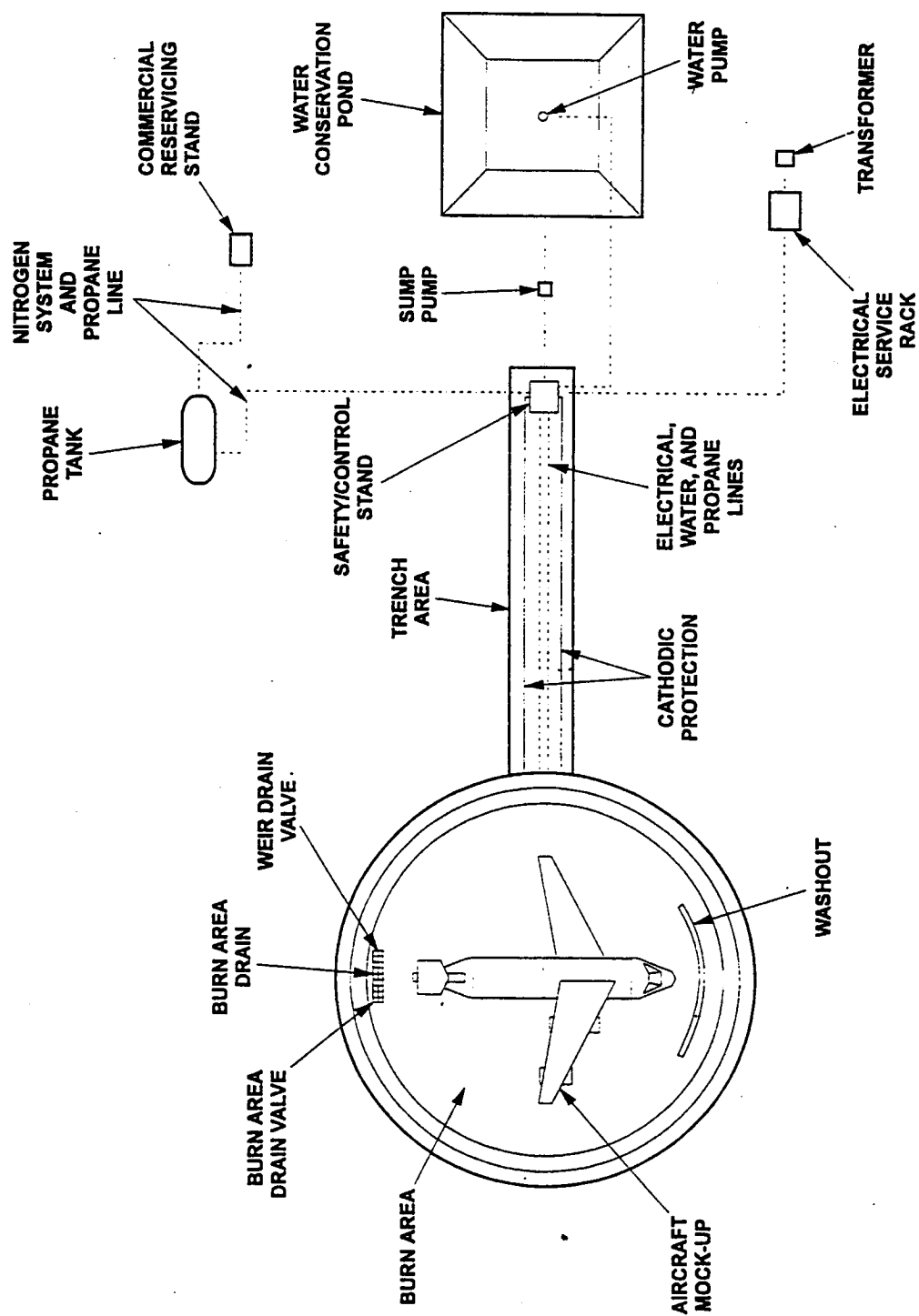


Figure 8. Goodfellow Air Force Base (Sheet 3 of 4)



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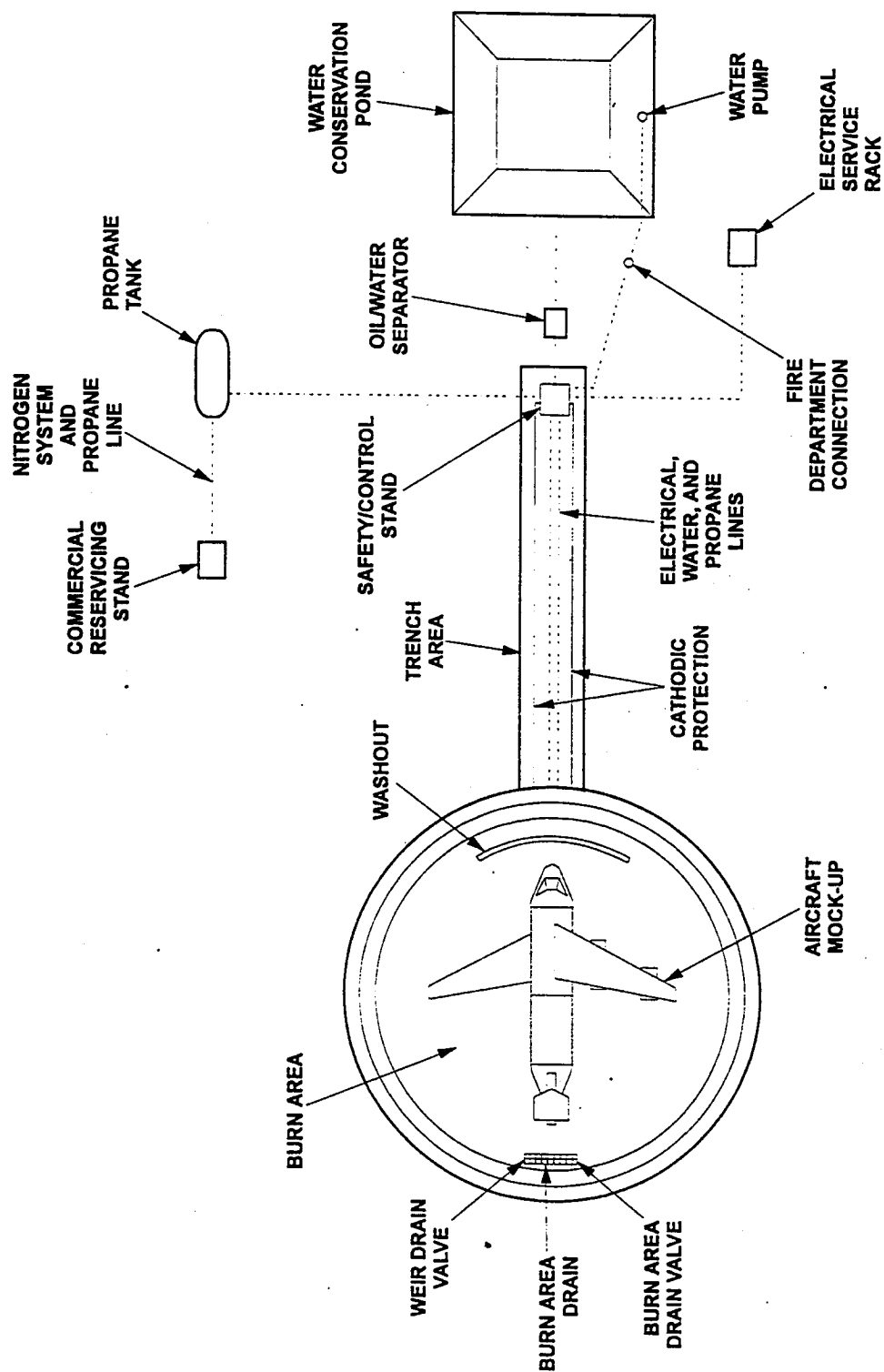
Figure 8. Goodfellow Air Force Base (Sheet 4 of 4)



DOVER AFB
DOVER, DELEWARE

FP1A1B9X

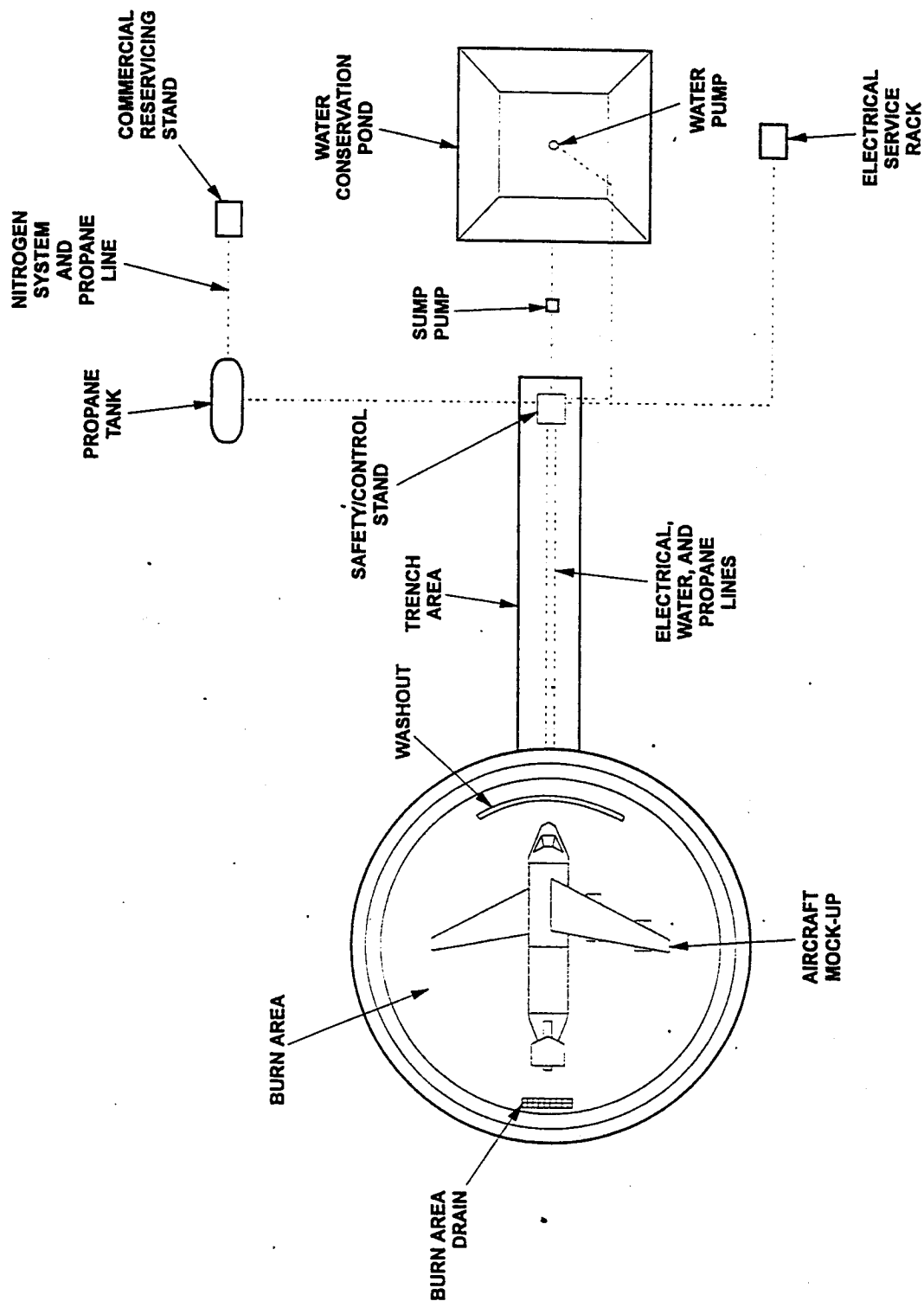
Figure 9. Dover Air Force Base



HILL AFB
OGDEN, UTAH

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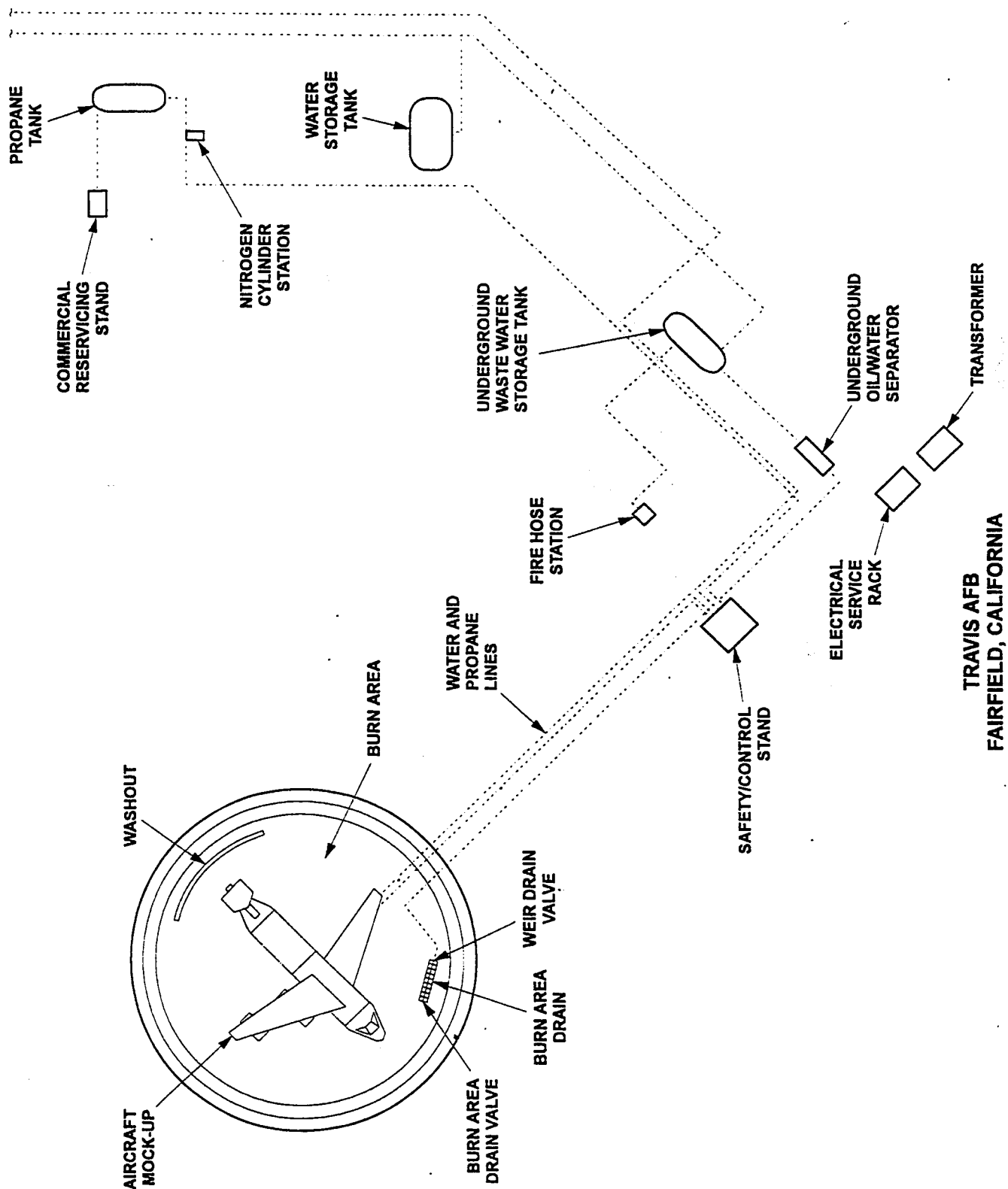
Figure 10. Hill Air Force Base



SCOTT AFB
BELLEVILLE, ILLINOIS

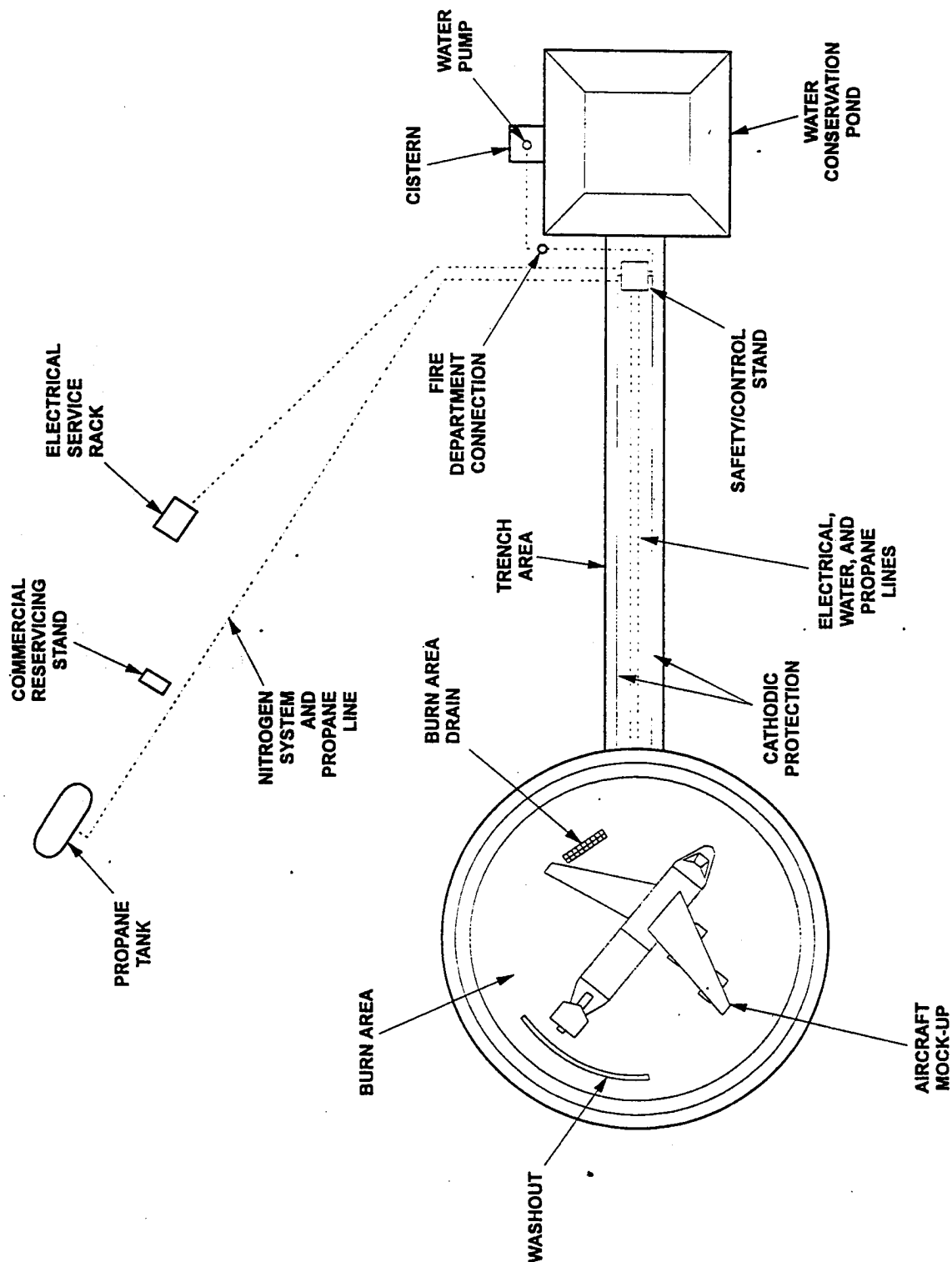
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Figure 11. Scott Air Force Base



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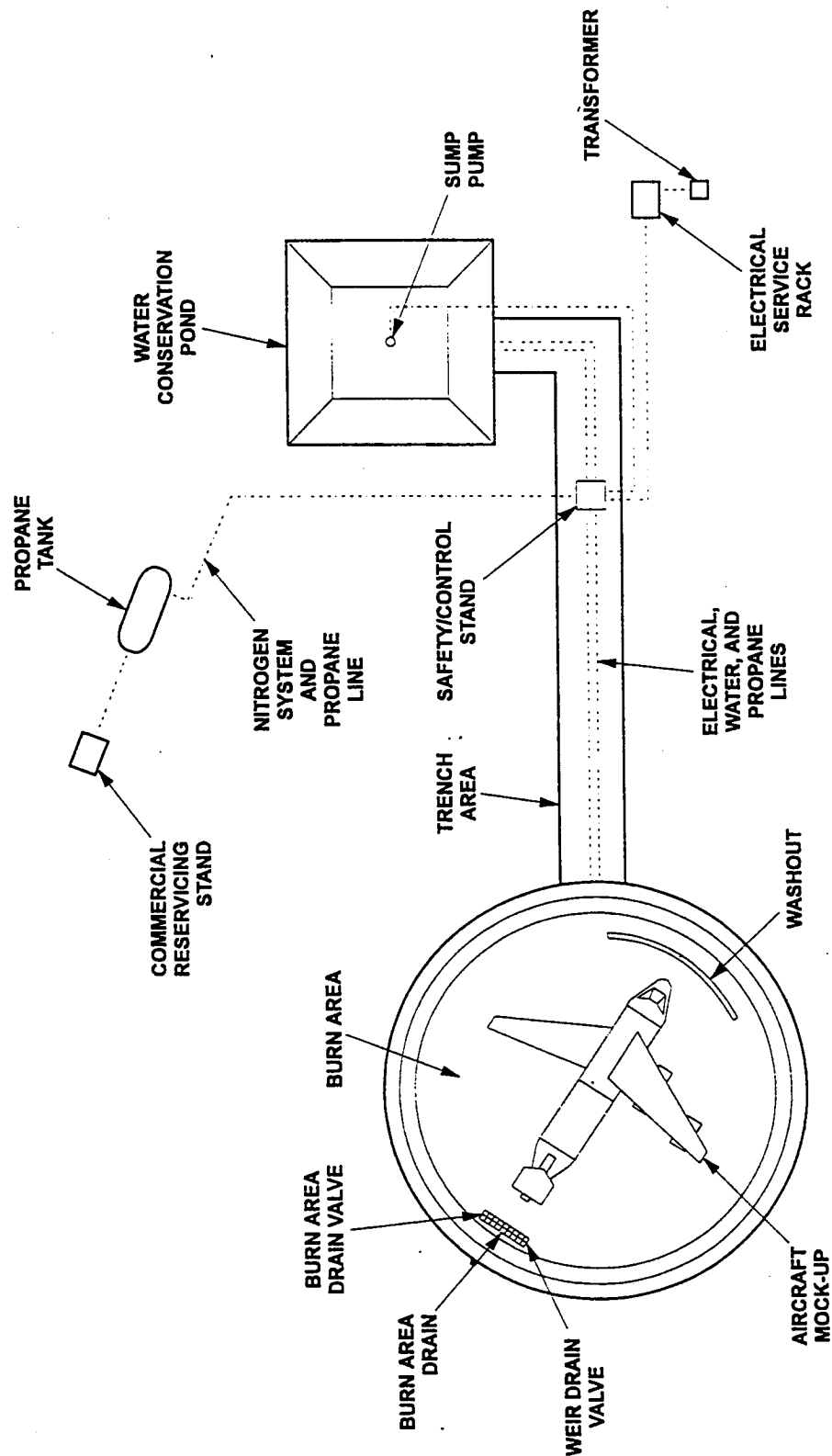
Figure 12. Travis Air Force Base



McCHORD AFB
TACOMA, WASHINGTON

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Figure 13. McChord Air Force Base



SHEPPARD AFB
WICHITA FALLS, TEXAS

FP1A1C5X

Figure 14. Sheppard Air Force Base

SUBORDINATE WORK PACKAGE

MAINTENANCE INSTRUCTIONS

GENERAL MAINTENANCE

EFFECTIVITY: CRASH FIRE RESCUE TRAINING FACILITY

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this SWP is 16

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FOREWORD

This work package contains maintenance procedures for the Crash Fire Rescue Training Facility (CFRTF). These procedures include liner maintenance and repair, locating liner leak, cut-out panel replacement, ignitor

replacement, excavation procedures, regulator adjustment (Table 1), water pump replacement, and inspection criteria table (Table 2).

SAFETY SUMMARY

Various steps in this work package may require personnel to be exposed to liquid propane vapor and fumes, and high voltage - low current electricity. It is imperative to wear appropriate protective clothing and to be aware of the EMERGENCY PROCEDURES in Work

Package 004 00, paragraphs 6 and 7. Failure to comply may cause serious injury.

Reference Material Required

None

1. IGNITOR REPLACEMENT.

There are 6 ignitors located on the ground in the burn area and 12 ignitors located on the mock-up.

WARNING

Ensure all electrical power to ignitors is off. Serious injury to personnel may result.

CAUTION

The entire training facility is a no smoking area.

NOTE

- Ignitor replacement procedures shall be performed by authorized personnel only.
- No vehicles are allowed in burn area.
 - a. Remove ignitor cover bolts (Figure 1).
 - b. Remove ignitor cover.
 - c. Disconnect ignitor pigtail connector and grounding wire (Figure 2).
 - d. Remove two ignitor mounting bolts, if applicable (Figure 1).
 - e. Remove ignitor, catalog number CH31723 or CH31615 (Figures 3 and 4).
 - f. If ignitor pigtail replacement is required, splice new pigtail in accordance with figure 5.
 - g. Reverse procedures to replace ignitor.
 - h. Once ignitor is replaced, functionally verify its operation by energizing the ignitor without applying propane.

2. CUT-OUT PANEL REPLACEMENT.

Cut-out panels are located on the aft left and right sides of the mock-up. The panels are 36 inches wide x 84 inches high and constructed of .031 inch thick sheet metal. If training scenario includes a forced entry extrication through cut-out panels, cut-out panels should be installed prior to training exercise.

CAUTION

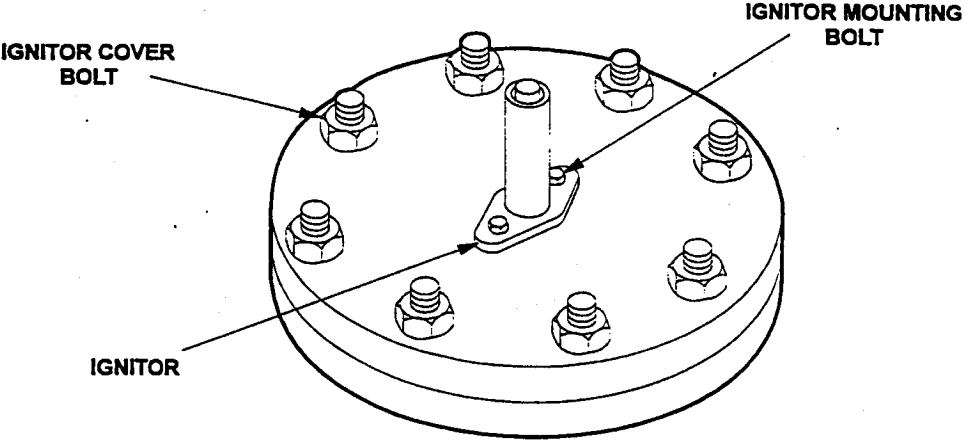
The entire training facility is a no smoking area.

NOTE

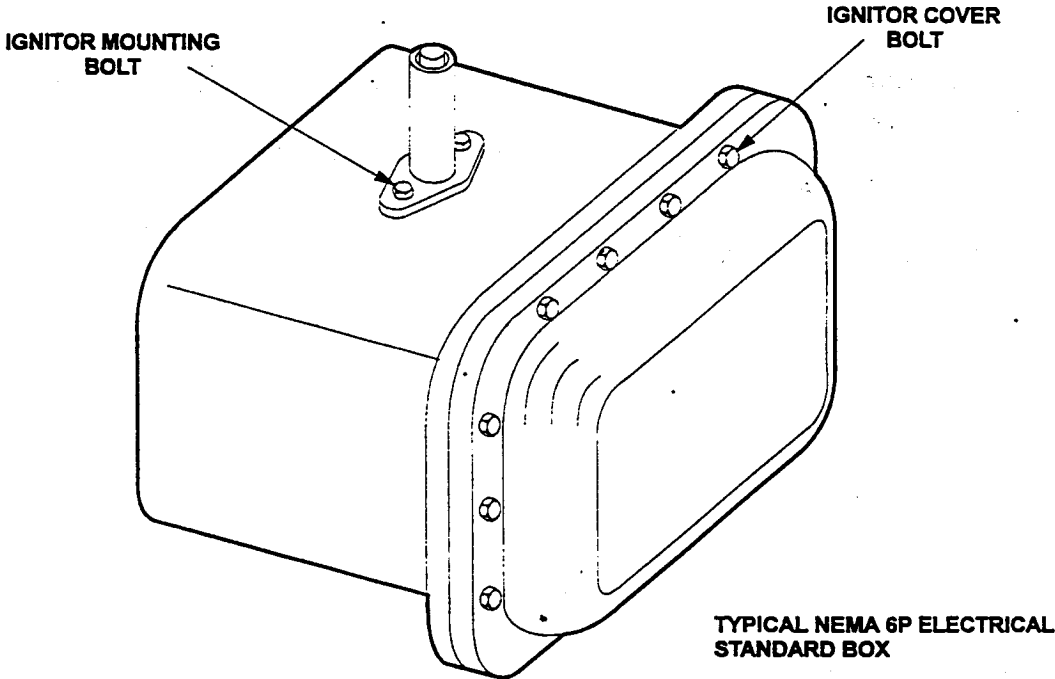
- Cut-out panel replacement procedures shall be performed by authorized personnel only.
- No vehicles are allowed in burn area.
 - a. Remove all nuts and bolts securing panel to mock-up.
 - b. Remove damaged panel and replace with new panel.
 - c. Replace nuts and bolts.

3. LINER MAINTENANCE.

The 80 mil thick high density polyethylene (HDPE) liners are located in the water conservation pond, burn area, and trench. Some sites may incorporate either a single liner or a dual liner. Instructions in this manual refer to a dual lined facility. The liners in the trench and burn pit are buried, see EXCAVATION PROCEDURES for excavation details.



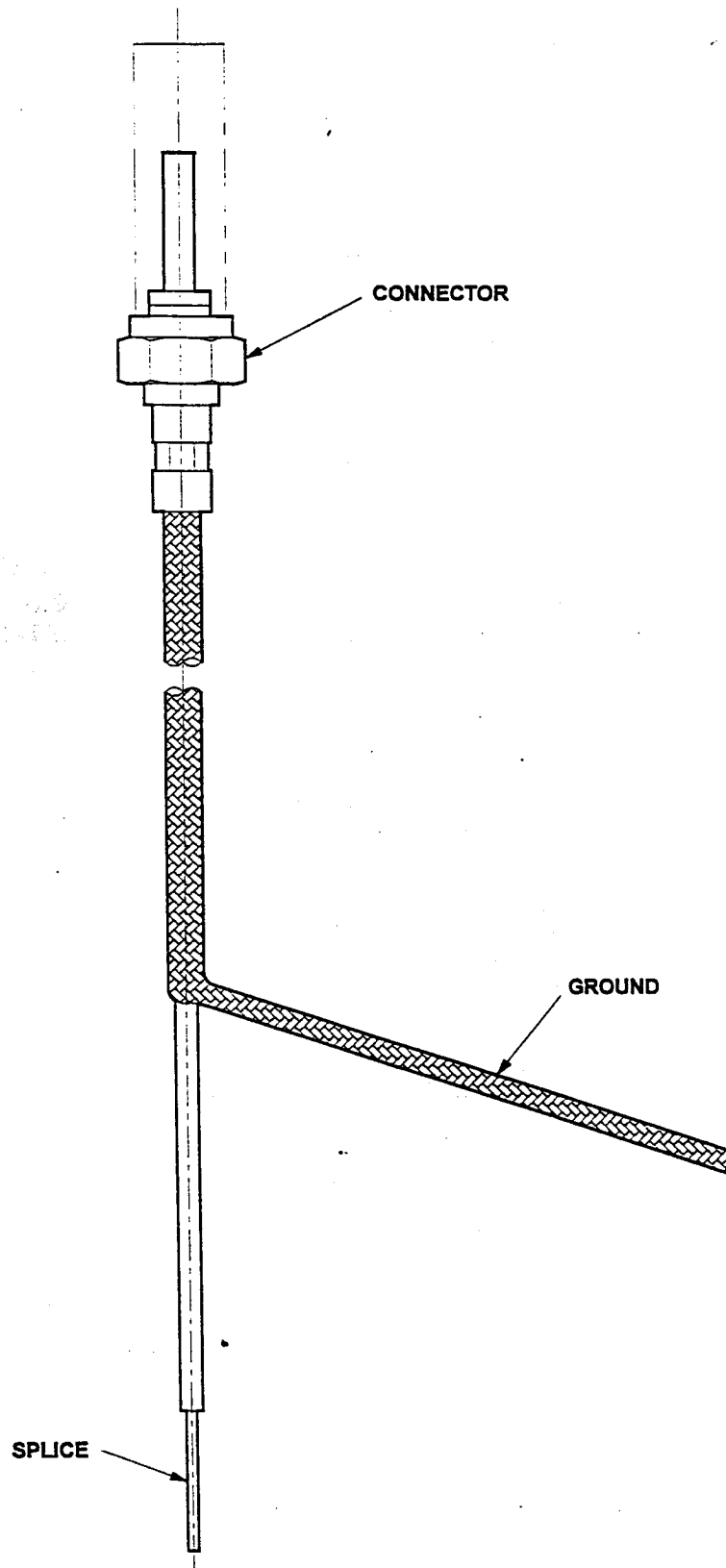
MOCK-UP IGNITOR ASSEMBLY



GROUND IGNITOR ASSEMBLY

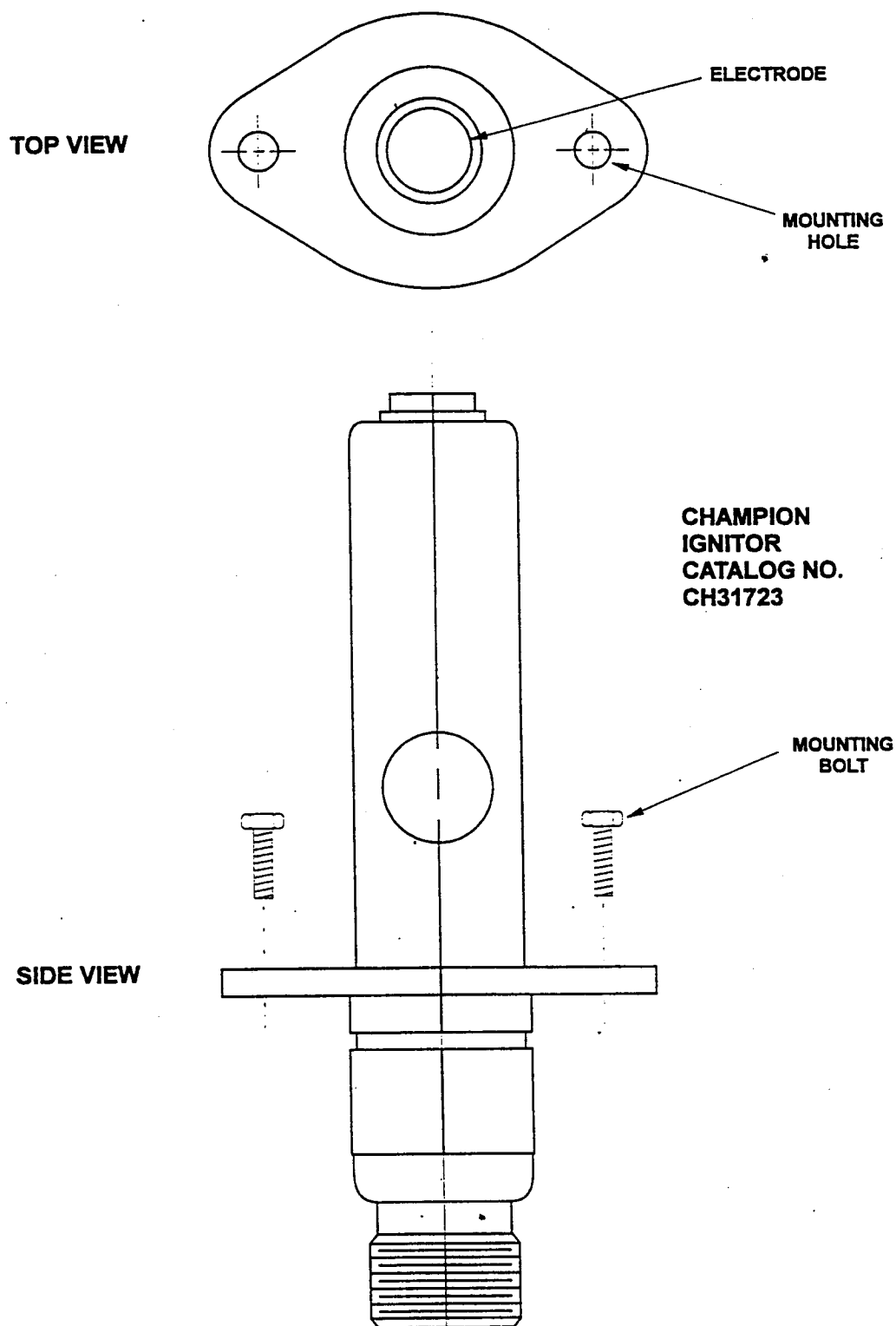
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Figure 1. Ignitor Assemblies



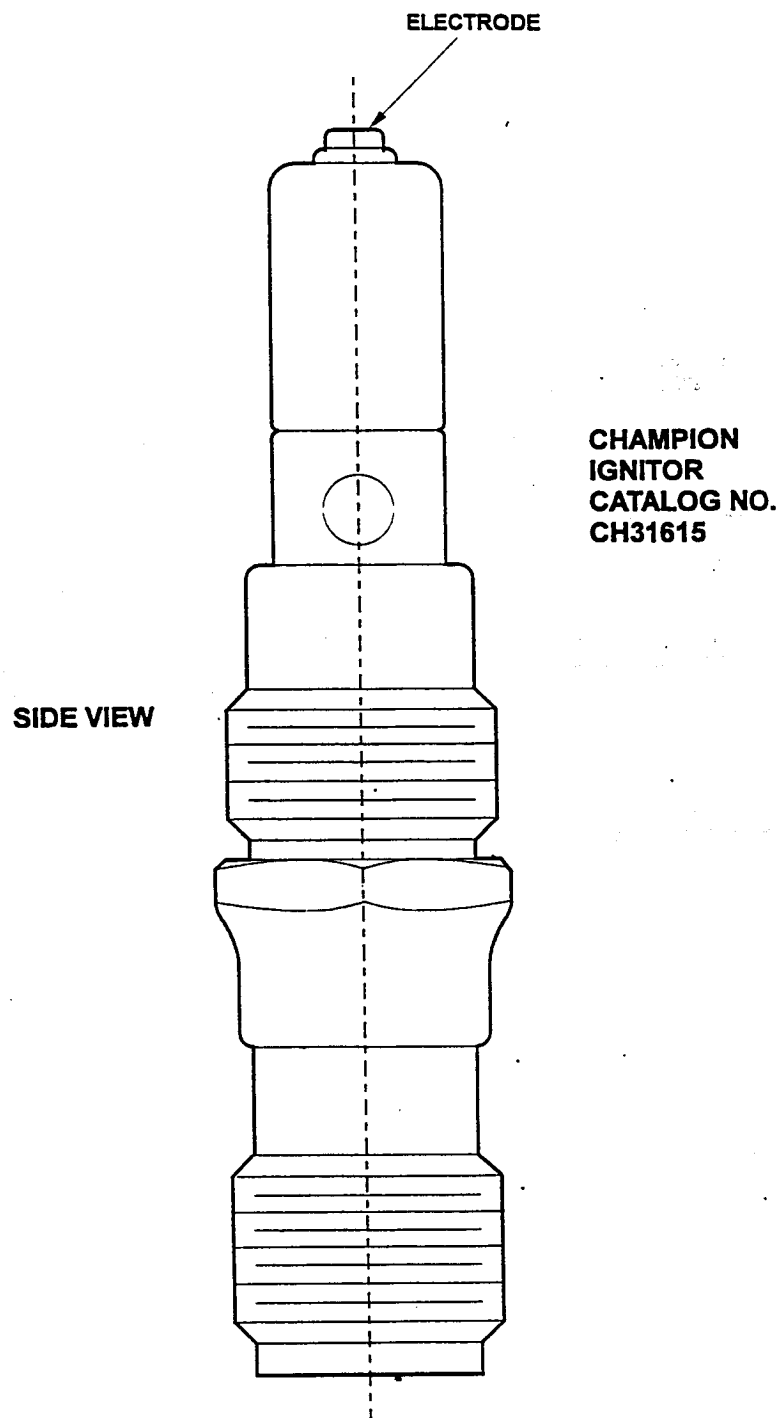
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Figure 2. Ignitor Connector and Pigtail



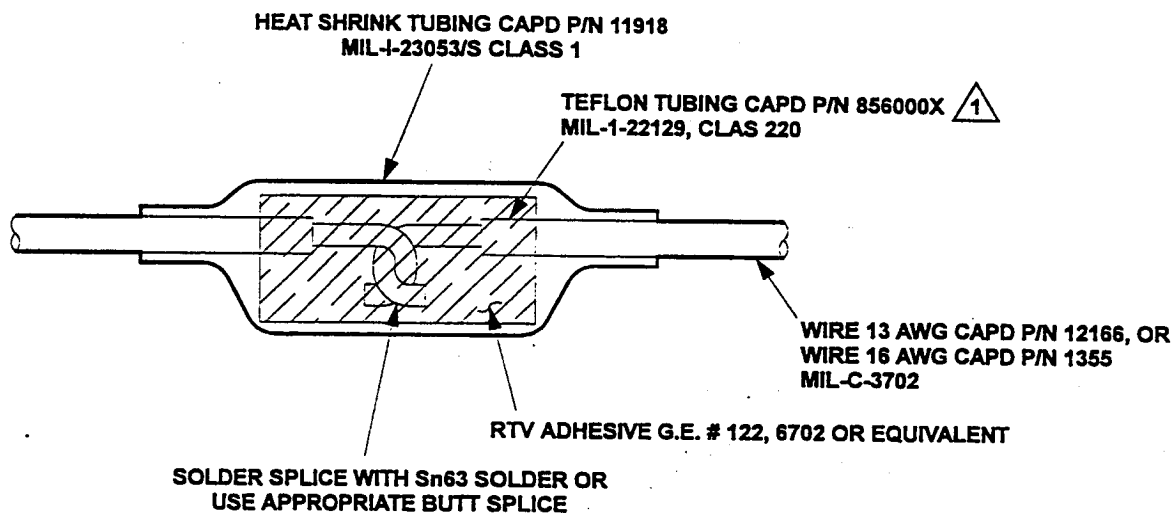
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Figure 3. Champion Ignitor, Cat. No. CH31723



FP1A102X

Figure 4. Champion Ignitor, Cat. No. CH31615



NOTE:

- ¹ USE P/N 8560002 (2 AWG) TUBING WITH 6MM, 13 AWG WIRE P/N 12166
USE P/N 8560003 (3 AWG) TUBING WITH 5MM, 16 AWG WIRE P/N 1355

FP1A1C6X

Figure 5. Ignitor Pigtail Splice Detail

4. LOCATING LINER LEAK - BURN AREA.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury.

CAUTION

The entire training facility is a no smoking area.

NOTE

- Liner maintenance procedures shall be performed by authorized personnel only.
- No vehicles are allowed in burn area.
 - a. Fill burn area and mark water level.
 - b. After 72 hours, water will leak down to level where leak is located.
 - c. Repair liner in accordance with manufacture's specifications and paragraph 7.

5. LOCATING LINER LEAK - WATER CONSERVATION POND.

WARNING

If an obvious unsafe or unserviceable condition is noted, halt operations and rectify condition prior to proceeding. Failure to halt and correct conditions may cause injury or death to personnel.

CAUTION

The entire training facility is a no smoking area.

NOTE

Liner leak location procedures shall be performed by authorized personnel only.

- a. Fill water conservation pond and mark water level.
- b. After 72 hours, water will leak down to level where leak is located.
- c. Repair liner in accordance with manufacture's specifications and paragraph 7.

6. EXCAVATION PROCEDURES.

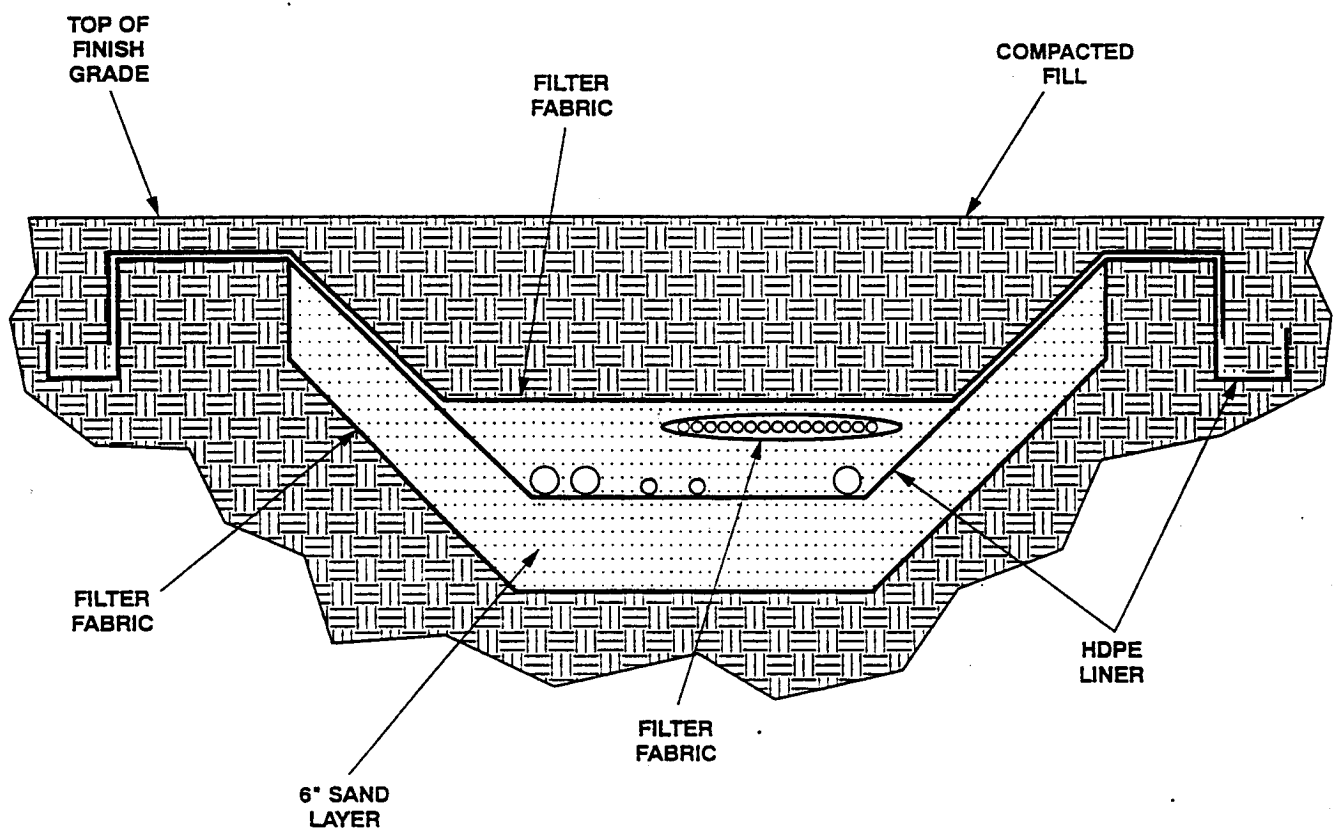
Excavation may be required to repair buried items in the burn area or trench (Figures 6 and 7).

CAUTION

- The entire training facility is a no smoking area.
- Be observant for yellow plastic warning tape buried 12 inches below surface. This warning tape indicates underground wiring, anodes, grounding cells, or reference electrodes. Prior to backfill ensure warning tape is properly replaced.

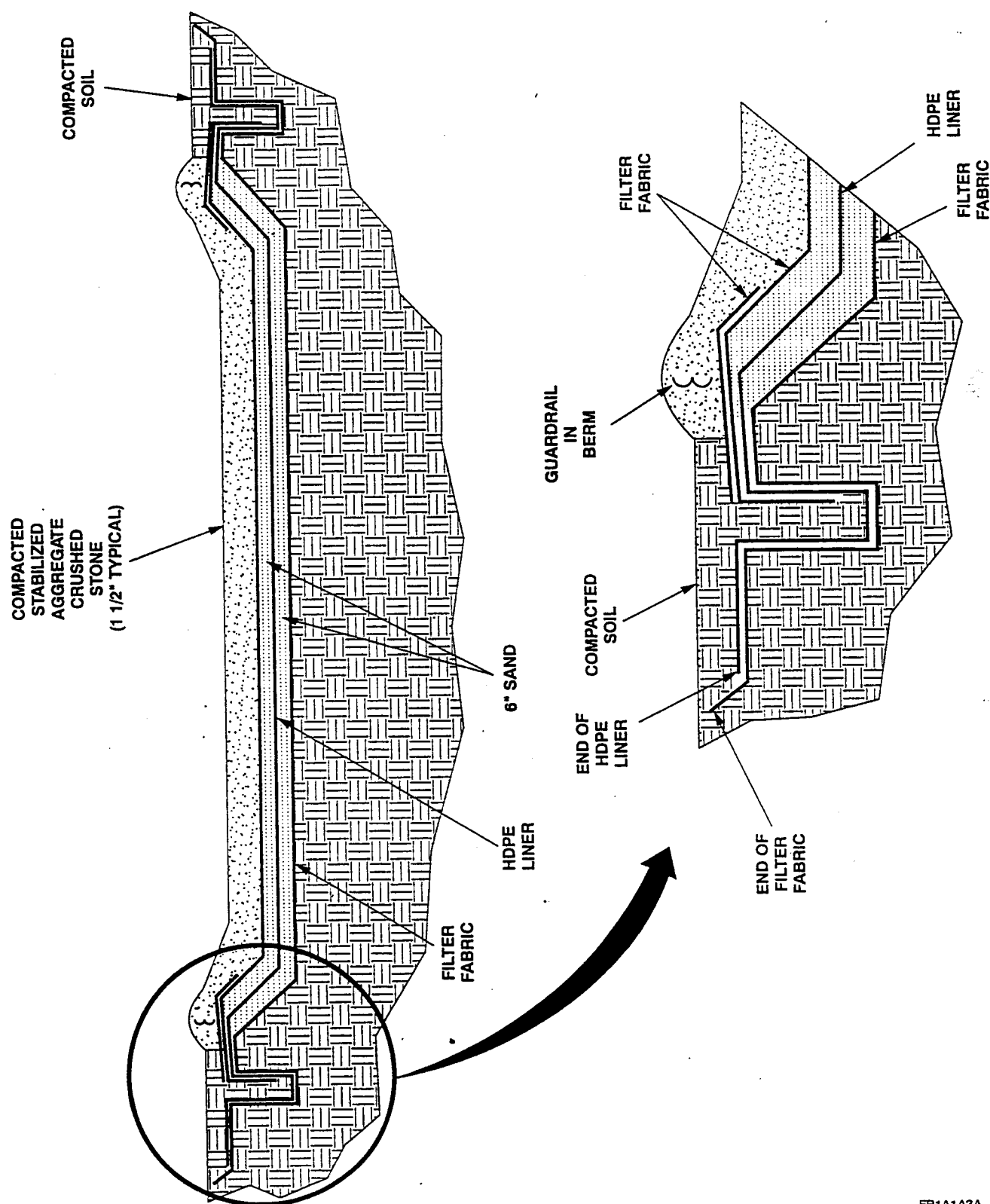
NOTE

- Excavation procedures shall be performed by authorized personnel only.
- No vehicles are allowed in burn area.
 - a. Remove required amount of fill in layers to expose item to be repaired, make sure to keep different fill types separated (Figure 8).
 - b. After repair is complete, backfill materials in appropriate order.



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Figure 6. Trench Area Detail



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Figure 7. Burn Area Detail

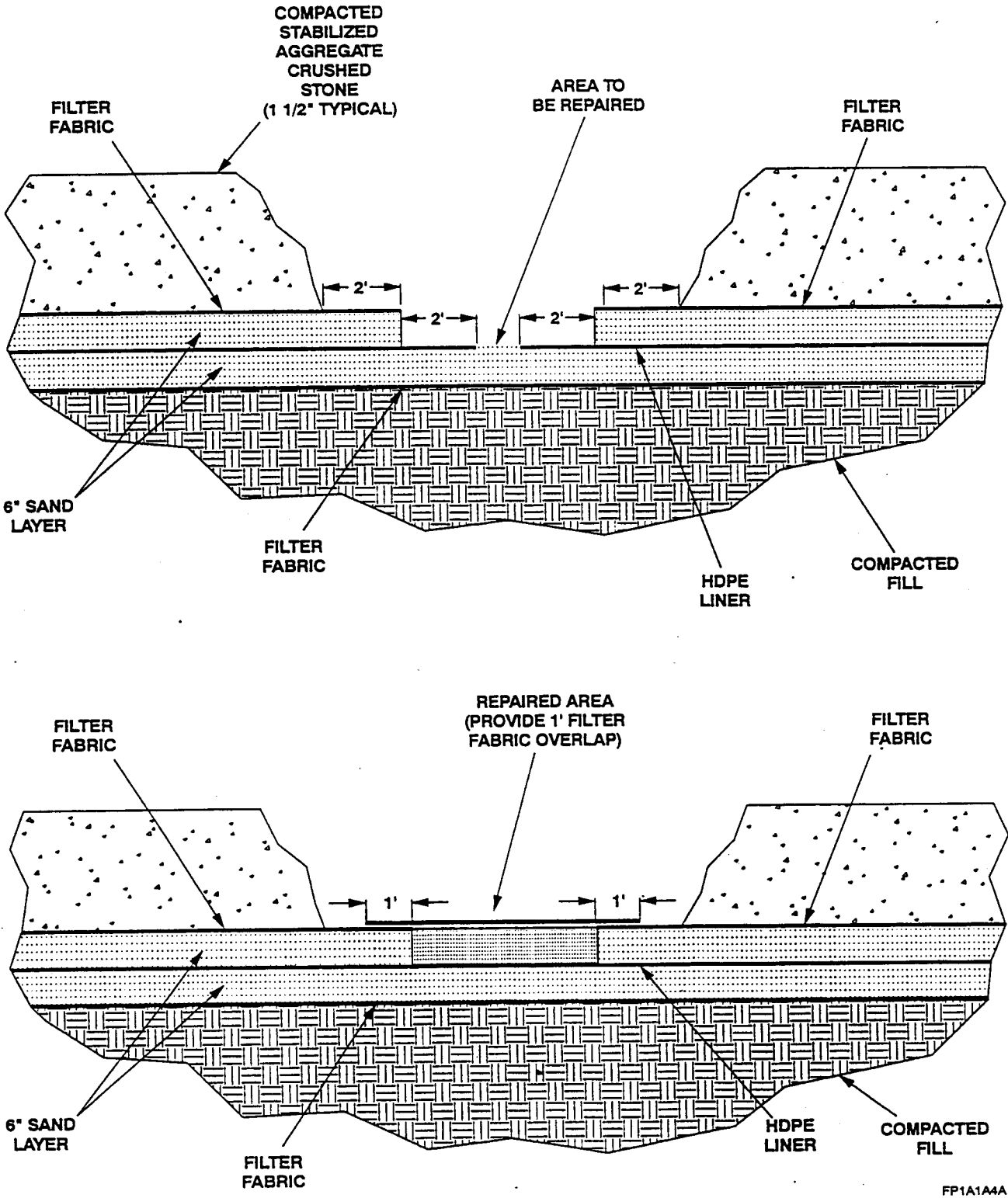


Figure 8. Excavation Detail

7. LINER REPAIR - GENERAL PROCEDURES

All liner repairs will be accomplished in accordance with the manufacturers instruction included with the GSE Extrusion Welder. In addition to published procedures, the following general procedures will be adhered to.

1. All seams and non-seam areas of the geomembrane will be examined for identification of effects, holes, blisters, unsupervised raw materials, and any sign of contamination by foreign matter.
2. Neither welding nor placement of geomembrane will take place during any precipitation, in the presence of excessive moisture, blowing dust, or in the presence of high winds (unless wind barriers are provided). In addition, neither placement nor welding will take place in areas of standing water.
3. The high temperature limit for welding is based on two factors: (1) The well-being of the crew: Black lining material will get very hot when expose to sunlight. It is possible that the elevated sheet temperature in conjunction with immoderate ambient conditions could place the well-being of the crew at risk. (2) Material capability: The highest temperature at which the materials can be properly welded is dependent upon such things as ambient temperature, wind, subgrade conditions, exposure to sunlight, material type, and material thickness to name a few.
4. Defective/damaged materials will be identified via a deficiency report. Actions taken to resolve or correct the problem will also be recorded on a similar form.
5. Defects, holes, blisters, undispersed raw materials, signs of contamination by foreign matter, unacceptable welds in geomembranes, and other unsatisfactory conditions will be identified. The repair/corrective action to repair the area will be recorded. Work will not proceed with any materials which will cover these areas until they are repaired. Types of repair/corrective actions area as follows:
 - a. Patching - use to repair large holes, tears, and contamination by foreign matter.
 - b. Buffing and re-welding - used to repair small sections of extruded seams.
 - c. Spot welding or seaming - used to repair pinholes, or other minor localized flaws
 - d. Capping - used to repair large lengths of failed seams
 - e. Topping - used to repair areas of inadequate seams which have an exposed edge
6. Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair.
7. All surfaces must be clean and dry at the time of the repair.
8. The repair procedures, materials, and techniques will be approved in advance of the specific repair by the site manager/contractor or Civil Engineering.
9. Patches or caps will extend at least six inches (6") beyond the edge of the defect, and all corners of patches will be rounded with a radius of at least three inches (3").
10. Any holes, tears, or burn-throughs in geotextiles will be repaired by patching with the same geotextile. The patch will be a minimum of twelve inches (12") larger in all directions than the area to be repaired and will be spot bonded thermally.
11. Any holes or tears in geonets will be repaired by patching the same geonet. The patch will be a minimum of twelve inches (12") overlap around the damaged area. For fabric-encases GCLs, the patch is to be tucked into place with excess bentonite poured over the overlap. Simple overlapping of the patch is sufficient for geomembrane backed GCLs. However, temporary attachment of patches is required to ensure that the patch is not dislodged by covering with a geomembrane or soil.

12. The extrusion welding system is utilized for repairs and detail work. The extrusion welding system produces a seam quality equal to the hot wedge weld (peel strengths are less only because of different geometrics) and has the advantage that all welds are applied on top of the geomembrane which allows its use at "T" intersections and in irregular seam areas such as pipe boots.
13. The extrusion welder shall have two independent heating zones, each with its own closed loop temperature control system. These two zones are typically referred to as the nozzle and the extruder. The nozzle thermocouple is positioned approximately one inch (1") from the end of the steel nozzle which rides on the sheet giving good control over the temperature of the molten polymer as it contacts the sheet.
14. The extruder and nozzle shall be insulated to prevent excessive heat loss in cold and/or windy conditions as well as to provide a safe working environment for the operator.
15. The extrusion welder is equipped with two counter-rotating tips in the nozzle to provide mixing of the extrudate at the zone of contact with the sheet.
16. A working and properly functioning small electric generator must be available within close proximity of the seaming region and with adequate extension cords to complete the entire seam. The generator must be rubber tired, or placed on a smooth plate such that it is completely stable so that no damage can occur to the geomembrane. Fuel (Gasoline or diesel) for the generator must be stored off the liner.
17. The Gundle extrusion welder is a completely self contained system which requires no adjustments after it has been set up for a particular geomembrane thickness.
18. An initial inspection of the extrusion welder should be made before it is heated to confirm that the electrical cords, insulation and covers are in good condition and that the welding nozzle is correct for the geomembrane to be seamed.
19. The welding machine should be connected to a proper power supply and heated to the correct welding temperature for the geomembrane to be seamed.
20. After the unit has reached correct operating temperature, a clean and dry welding rod should be inserted and the unit operated for several minutes to confirm that temperature controllers are operating properly and that the welding rod feed system and rotating tips are operating properly.
21. The flow of extrudate from the test run will force the rotating tips to their outermost position and they can then be checked for proper setting with depth calipers.
22. The Teflon shoes at the nozzle should be checked for excessive wear and replaced if necessary. The Teflon shoes must be trimmed for proper control of the weld bead configuration.
23. Geomembrane to be extrusion welded must have low molecular weight polymer (waxes) and surface oxidation removed by lightly grinding the weld surface with an 80 grit disc. The grinding is performed parallel to the seam and controlled such that grinding marks do not extend more than 0.25 inches outside the area of the weld bead. Grinding should not precede welding by more than one hour. Sixty (60) mil or thicker liners should have the edge of the top sheet beveled by grinding to approximately a 45 degree angle.
24. The geomembrane to be extrusion welded must be temporarily bonded to hold the material in place until the extrusion weld bead cools and attains full strength. Automatic or hand-held hot air tack welds are therefore applied prior to extrusion welding.
25. The extrusion welder barrel should be purged of all degraded polymer prior to the start of seaming.
26. The welding operation should be observed to assure that the weld bead is centered over the

edge of the top overlapped sheet and that weld bead appearance is smooth and uniform.

27. All extrusion welds should be non-destructively tested by vacuum testing as described in the manufacturers manual. Areas which cannot be non-destructively tested should be capped or welded with excess extrudate.

8. REGULATOR ADJUSTMENT.

NOTE

Do not adjust regulators during any training exercise or with personnel within vicinity of mock-up, if applicable.

- a. Regulator pressure shall be adjusted in accordance with Table 1.

Table 1. Burner Pressure Regulator Settings.

BURNER LOCATION	OPTIMAL FLAME HEIGHT
Engine Burners	Fully engulfed
Internal Burners	6-8 Feet

- b. Loosen stop nut, adjust to proper PSI level for appropriate burner, tighten stop nut.

9. WATER PUMP REPLACEMENT.

- a. Gain access to water pump.
- b. Disconnect applicable piping and wiring.
- c. Remove pump.
- d. Replace pump by reversing removal procedure.

Table 2. Inspection Criteria

ITEM	INSPECTION	TYPE DEFECT	DISPOSITION
Piping	Excessive corrosion/ cracks	Major	Replace
Mock-up	Excessive corrosion	Major	Replace
Control stand	Excessive corrosion	Major	Replace
Ignitor	Cracked insulator	Major	Replace
Regulator	Defective Diaphragm	Major	Replace
Ignitor Switch	Fails to Operate	Major	Determine Malfunction and Remove and Replace if Nec- essary
Manual Valve	Fails to Operate	Major	Determine Malfunction and Remove and Replace if Nec- essary
Solenoid	Fails to Operate or Leaks	Major	Determine Malfunction and Remove and Replace if Nec- essary
Seismic Switch (If applicable)	Fails to Operate	Major	Replace
Water Pump	Fails to Operate	Major	Determine Malfunction and Remove and Replace if Nec- essary
Water Pump	Low Water Pressure	Major	Reseat Motor Seal and Check for Debris. Remove and Replace if Necessary
Propane Flow	Low Pressure	Major	Check LPG Tank Level, Sole- noids and Valves
Propane Flow	No Pressure	Major	Check excess flow valve located in discharge side of storage tank.
Nitrogen Bottles (If applicable)	Low Pressure	Major	Replace or Reservice
Main Power Switch	Fails to Operate	Major	Replace
Pneumatic System	Fails to Operate	Major	Check for Leaks. Repair or Replace Components